# SPECIFICATIONS

# ST. PAUL CATHOLIC CHURCH PARISH LIFE CENTER

**1002 Convent Street**
**Pocahontas, Arkansas 72450**

ARCHITECT'S PROJECT NO.
130613

AUGUST 5, 2017


ARCHITECT:

MSA

MATT SILAS ARCHITECT
212 east washington ave.
p.o. box 1702
jonesboro, arkansas 72403

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**SECTION 00001**

**PROJECT TITLE PAGE**

**SET NUMBER _____**

**AUGUST 5, 2017**

**PROJECT MANUAL**

# ST. PAUL CATHOLIC CHURCH
# PARISH LIFE CENTER

**1002 Convent Street**

**Pocahontas, Arkansas 72450**

**ARCHITECT'S PROJECT NUMBER**

**130613**

**OWNER:**

## ST. PAUL CATHOLIC CHURCH

**1002 CONVENT STREET - POCAHONTAS, ARKANSAS 72455**

**ARCHITECT:**

MSA

MATT SILAS ARCHITECT
**212 east washington ave.**
**p.o. box 1702**
**jonesboro, arkansas 72403**

**tel: (870) 268-0500**
**fax: (870) 268-0501**
**email: mattsilas@sbcglobal.net**

# SECTION 00002

# PROJECT INFORMATION

## PART 1 GENERAL

### 1.01 PROJECT IDENTIFICATION

A. Project Name: ST. PAUL CATHOLIC CHURCH PARISH LIFE CENTER, located at 1002 Convent Street, Pocahontas, Arkansas.

B. Project Number: 130613.

### 1.02 NOTICE TO PROSPECTIVE BIDDERS

A. These documents constitute an Invitation to Bid to General Contractors for the construction of the project described below.

B. Bid Date: Tuesday, September 19, 2017 at 3:00 local time.

### 1.03 PROJECT DESCRIPTION

A. Summary Project Description: See Section 01100.

B. Contract Scope: New Construction and Paving.

C. Contract Terms: Lump sum (fixed price, stipulated sum).

### 1.04 PROJECT CONSULTANTS

A. The Architect, hereinafter referred to as Matt Silas Architect.
   1. Address: 212 East Washington Ave.
   2. City, State, Zip: Jonesboro, Arkansas 72401.
   3. Phone/Fax: (870) 268-0500 / (870) 268-0501.
   4. E-mail: mattsilas@sbcglobal.net.

### 1.05 PROCUREMENT TIMETABLE

A. Notice to Proceed: Within 7 days after due date.

B. Bids May Not Be Withdrawn Until: 30 days after due date.

C. Contract Time: Contractor to allocate on bid form.

D. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

### 1.06 PROCUREMENT DOCUMENTS

A. Availability of Documents: Complete sets of procurement documents may be obtained:

   1. From the Office of the Architect
      a. for a 100% refundable deposit in the amount of $200.00 to General Contractors for (1) set. Additional sets are non-refundable.
      b. for a non-refundable deposit in the amount of $200.00 to Sub-contractors.
      c. Payable to Matt Silas Architect.
      d. **NO PARTIAL SETS DISTRIBUTED**.

**END OF SECTION**

**SECTION 00007**

**SEALS PAGE**

**DISCLAIMER:**

**THE ARCHITECT HAS PREPARED AND IS RESPONSIBLE FOR THE SECTIONS OF THESE SPECIFICATIONS IN DIVISIONS 0 - 14. ANY DELETION OR MODIFICATION OF THE ARCHITECT'S SPECIFICATIONS SHALL RELIEVE THE ARCHITECT OF ANY LIABILITY. IN SUCH AN EVENT, THE MODIFIER SHALL BE HELD LIABLE FOR MISSING AND MODIFIED INFORMATION.**


**ARCHITECT'S SEAL**

**END OF SEALS PAGE**

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**END OF LIST OF DRAWINGS**

# SECTION 00100

## BID SOLICITATION

**FROM:**

**1.01 The Owner: ST. PAUL CATHOLIC CHURCH.**

A. 1002 Convent Street.

B. Pocahontas, Arkansas 72455

**1.02 Owner's Agent / Representative**

A. Mr. Kyle Baltz.

**1.03 And the Architect (hereinafter referred to as Matt Silas Architect):**

A. Matt Silas

B. 212 East Washington Ave.

C. P.O. Box 1702

D. Jonesboro, Arkansas 72403

**1.04 TO: POTENTIAL BIDDERS**

A. Your firm is invited to submit an offer under seal to the Owner for the construction of a Parish Life Center as indicated in bid documents located at 1002 Convent Street, Pocahontas, Arkansas.

B. Bid Date / Location: Tuesday, September 19, 2017 at 3:00 local time for bid opening at the office of the Architect.

D. Refer to other bidding requirements described in Document 00200 - Instructions to Bidders.

E. Submit your offer on the Bid Form provided and deliver to Mr. Matt Silas at the bid location listed above by the time required for the opening of Bids in a sealed, opaque envelope clearly identified as a Bid with the project name, contractor's name and license number.

F. Your offer will be required to be submitted under a condition of irrevocability for a period of 30 days after submission.

G. The Owner reserves the right to accept or reject any or all offers and waive any formalities.

**END OF BID SECTION**

# SECTION 00200

# INSTRUCTIONS TO BIDDERS

## INVITATION

### 1.01 BID SUBMISSION

A. Bids signed and under seal, executed and dated will be received by the owner at the time and place listed in Section 00100.

B. Offers will be opened as indicated by the owner at the owner's discretion.

### 1.02 INTENT

A. The intent of this Bid request is to obtain an offer to perform work previously identified for a Stipulated Sum contract, in accordance with the Contract Documents.

### 1.03 WORK IDENTIFIED IN THE CONTRACT DOCUMENTS

A. Work of this proposed Contract comprises of site development and building construction, including minor demolition, general construction, minor structural, mechanical, electrical, and plumbing Work.

### 1.04 CONTRACT TIME

A. Contractor to stipulate time required to perform the Work and indicate on Bid Form.

## BID DOCUMENTS AND CONTRACT DOCUMENTS

### 2.01 DEFINITIONS

A. Bid Documents: Contract Documents supplemented with Invitation To Bid, Instructions to Bidders, Information Available to Bidders, Bid Form Bid securities identified.

B. Contract Documents: Defined in AIA A201 Article 1 including issued Addenda.

C. Bid, Offer, or Bidding: Act of submitting an offer under seal.

D. Bid Amount: Monetary sum identified by the Bidder in the Bid Form.

### 2.02 CONTRACT DOCUMENTS IDENTIFICATION

A. The Contract Documents consists of documents prepared by the Architect and the Architect's consultants.

### 2.03 AVAILABILITY

A. Bid Documents may be obtained from the Owner and the Architect as follows:

1. General Contractors: 100% refundable deposit in the amount of $200.00 for one set. Additional sets are non-refundable.

2. Subcontractors: Non- refundable deposit in the amount of $200.00.

3. **NO PARTIAL SETS WILL BE ISSUED.**

### 2.04 INQUIRIES / ADDENDA

A. Questions shall be directed as follows:
1. Matt Silas Architect: Architectural and Engineering Documents.

B. Addenda may be issued during the bidding period. All Addenda become part of the Contract Documents. Include resultant costs in the Bid Amount.

C. Verbal answers are not binding on any party.

D. Clarifications requested by bidders must be in writing not less than 7 days before date set for receipt of bids. The reply will be in the form of an Addendum, a copy of which will be

forwarded to known recipients and others requesting such information.

**2.05 PRODUCT/ASSEMBLY/SYSTEM SUBSTITUTIONS**

A. Where the Bid Documents stipulate a particular product, substitutions will be considered up to 5 days before receipt of bids.

B. When a request to substitute a product is made, Matt Silas Architect may approve the substitution and will issue an Addendum to known bidders.

C. The submission shall provide sufficient information to determine acceptability of such products.

D. Provide complete information on required revisions to other work to accommodate each proposed substitution.

E. Provide products as specified unless substitutions are submitted in this manner and accepted.

F. See Section 01600 - Product Requirements for additional requirements.

**SITE ASSESSMENT**

**3.01 EXAMINATION**

A. The bidder is encouraged to visit the project site prior to submitting a bid.

**QUALIFICATIONS**

**4.01 EVIDENCE OF QUALIFICATIONS**

A. To demonstrate qualification for performing the Work of this Contract, bidders may be requested to submit written evidence of financial position, license to perform work in the State.

**4.02 SUBCONTRACTORS/SUPPLIERS/OTHERS**

A. The Owner reserves the right to reject a proposed subcontractor for reasonable cause.

**BID SUBMISSION**

**5.01 SUBMISSION PROCEDURE**

A. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

B. Submit one copy of the executed offer on the Bid Forms provided, signed and sealed with the required security in a closed opaque envelope, clearly identified with bidder's name, project name and Owner’s name on the outside.

C. Improperly completed information, irregularities in bid bond, may be cause not to open the Bid Form envelope and declare the bid invalid or informal.

**5.02 BID INELIGIBILITY**

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, will at the discretion of the Owner, be declared unacceptable.

B. Bid Forms, Appendices, and enclosures that are improperly prepared will, at the discretion of the Owner, be declared unacceptable.

C. Failure to provide security deposit, bonding or insurance requirements will, at the discretion of the Owner, be waived.

D. Bids are by invitation only from selected bidders. Bids from unsolicited bidders may be returned.

**BID ENCLOSURES/REQUIREMENTS**

**6.01 PERFORMANCE ASSURANCE**

A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00800 - Supplementary Conditions.

**6.02 INSURANCE**

A. Provide an executed "Undertaking of Insurance" on a standard form provided by the insurance company stating their intention to provide insurance to the bidder in accordance with the insurance requirements of the Contract Documents.

**6.03 BID FORM REQUIREMENTS**

A. Complete all requested information in the Bid Form and Appendices.

**6.04 FEES FOR CHANGES IN THE WORK**

A. Include in the Bid Form, the fees proposed for subcontract work for changes (both additions and deductions) in the Work. Contractor shall apply fees as noted, to the subcontractor's gross (net plus fee) costs on additional work.

**6.05 BID FORM SIGNATURE**

A. The Bid Form shall be signed by the bidder, as follows:
   1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
   2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
   3. Corporation: Signature of a duly authorized signing officer(s) in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, a copy of the by-law resolution of their board of directors authorizing them to do so, must also be submitted with the Bid Form in the bid envelope.

**6.06 ADDITIONAL BID INFORMATION**

A. Submit the following Supplements concurrent with bid submission:
   1. Document 00431 - Supplement A - Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.
   2. Document 00433 - Supplement B - Alternates: Include the cost variation to the Bid Amount applicable to the Work described in Section 01230.

**OFFER ACCEPTANCE / REJECTION**

**7.01 DURATION OF OFFER**

A. Bids shall remain open to acceptance and shall be irrevocable for a period of thirty (30) days after the bid closing date.

**7.02 ACCEPTANCE OF OFFER**

A. The Owner reserves the right to accept or reject any or all offers.

B. After acceptance by the Owner, Matt Silas Architect on behalf of the Owner, will issue to the successful bidder, a written Notice To Proceed.

**7.03 STANDARD OPERATING GUIDELINES FOR CONTRACTORS**

A. Insurance Certificate on file with the Owner.
   1. Policies list the Owner as an additional insured.
   2. Arkansas Worker's Compensation as required by law,
   3. $1,000,000.00 Minimum General Liability
   4. $1,000,000.00 Minimum Auto Liability.

B. Contractor shall sign Attachment to Bid.

**END OF SECTION**

**SECTION 00410**

**BID FORM**

**THE PROJECT AND THE PARTIES**

**1.01 TO:**

A. Mr. Kyle Baltz

B. 1002 Convent Street

B. Pocahontas, Arkansas 72455

**1.02 FOR:**

A. ST. PAUL CATHOLIC CHURCH PARISH LIFE CENTER located at 1002 Convent Street in Pocahontas, Arkansas

**1.03 DATE: _____ (Bidder to enter date)**

**1.04 SUBMITTED BY: (Bidder to enter name and address)**

A. Bidder's Full Name _____

1. Address _____

2. City, State, Zip _____

**1.05 OFFER**

A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by Matt Silas Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

B. _____

_____ dollars

($_____), in lawful money of the United States of America.

C. We have included the required security Bid Bond as required by the Instruction to Bidders.

D. All applicable federal taxes are included and State of Arkansas taxes are included in the Bid Sum.

**1.06 ACCEPTANCE**

A. This offer shall be open to acceptance and is irrevocable for thirty days from the bid closing date.

B. If this bid is accepted by the Owner within the time period stated above, we will:
1. Execute the Agreement within seven days of receipt of acceptance of this bid.
2. Furnish the required bonds within seven days of receipt of acceptance of this bid.
3. Commence work within 7 days after written Notice to Proceed of this bid.

C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the

difference between this bid and the bid upon which a Contract is signed.

D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

**1.07 CONTRACT TIME**

A. If this Bid is accepted, we will:

B. Complete the Work in (_____) consecutive calendar days from Notice to Proceed.

**1.08 CHANGES TO THE WORK**

A. When Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:

1. _____ percent overhead and profit on the net cost of our own Work;

2. _____ percent on the cost of work done by any Subcontractor.

B. On work deleted from the Contract, our credit to the Owner shall be Architect-approved net cost plus _____ of the overhead and profit percentage noted above.

**1.09 ADDENDA**

A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

1. Addendum # _____ Dated _____.

2. Addendum # _____ Dated _____.

3. Addendum # _____ Dated _____.

**1.10 BID FORM SUPPLEMENTS**

A. The following Supplements are attached to this Bid Form and are considered an integral part of this Bid Form:
1. Document 00431 - Supplement A - Subcontractors: Include the names of all Subcontractors and the portions of the Work they will perform.

**1.11 BID FORM SIGNATURE(S)**

A. The Corporate Seal of

B. _____

C. (Bidder - print the full name of your firm)

D. was hereunto affixed in the presence of:

E. _____

F. (Authorized signing officer, Title)

G. (Seal)

H. _____

I. (Authorized signing officer, Title)

**1.12 If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.**

**END OF BID FORM**

**SECTION 00431**

**SUPPLEMENT A - LIST OF SUBCONTRACTORS**

**PARTICULARS**

**Herewith is the list of Subcontractors referenced in the bid submitted by:**

**Bidder:** _____

**To Owner:** **ST. PAUL CATHOLIC CHURCH**

**Dated** _____ **and which is an integral part of the Bid Form.**

**The following work will be performed (or provided) by Subcontractors and coordinated by us:**

**LIST OF SUBCONTRACTORS**

| **WORK SUBJECT** | **SUBCONTRACTOR NAME** |
|---|---|
| **HVAC CONTRACTOR** | _____ |
| **PLUMBING CONTRACTOR** | _____ |
| **ELECTRICAL CONTRACTOR** | _____ |
| **FIRE PROTECTION** | _____ |
| **ROOFING** | _____ |
| **PRE-ENGINEERED METAL BUILDING MANUFACTURER** | _____ |

**END OF SUPPLEMENT A**

# SECTION 00500

# AGREEMENT

## PART 1 GENERAL

### FORM OF AGREEMENT

**1.01 Acceptable forms of agreement are as follows:**

A. AIA Document A101, Owner-Contractor Agreement Form - Stipulated Sum 2007 Edition, forms the basis of Contract between the Owner and Contractor.

B. Owner provided agreement.

**1.02 RELATED REQUIREMENTS**

A. Section 00700 - General Conditions.

B. Section 00800 - Supplementary Conditions.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION (NOT USED)

**END OF AGREEMENT**

# SECTION 00590

# CONTRACTING FORMS AND SUPPLEMENTS

## PART 1 GENERAL

### 1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. The Agreement form is AIA A101 ( Owner may opt to use another agreement type) .

B. The General Conditions are AIA A201.

C. All forms shall be current accepted forms.

### 1.02 FORMS

A. Use the following forms, when required, for the specified purposes unless otherwise indicated elsewhere in the Contract Documents .

B. Bond Forms:
   1. Performance and Payment Bond Form: AIA A312.

C. Post-Award Certificates and Other Forms:
   1. Schedule of Values Form: AIA G703.
   2. Application for Payment Form: AIA G702 and G703.

D. Clarification and Modification Forms:
   1. Supplemental Instruction Form: AIA G710.
   2. Construction Change Directive Form: AIA G714.
   3. Change Order Form: AIA G701.

E. Closeout Forms:
   1. Certificate of Substantial Completion Form: AIA G704.

### 1.03 REFERENCE STANDARDS

A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum.

B. AIA A201 - General Conditions of the Contract for Construction.

C. AIA A312 - Performance Bond and Payment Bond.

D. AIA G701 - Change Order.

E. AIA G702 - Application and Certificate for Payment.

F. AIA G703 - Continuation Sheet.

G. AIA G704 - Certificate of Substantial Completion.

H. AIA G710 - Architect's Supplemental Instructions.

I. AIA G714 - Construction Change Directive.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 00700

# GENERAL CONDITIONS

## FORM OF GENERAL CONDITIONS

1.01 The General Conditions applicable to this contract are AIA A201. The contractor is responsible for obtaining the General Conditions.

## RELATED REQUIREMENTS

2.01 Section 00800 - Supplementary Conditions.

2.02 Section 01422 - Definitions.

## SUPPLEMENTARY CONDITIONS

3.01 Refer to Document 00800 for amendments to these General Conditions.

END OF DOCUMENT

# SECTION 00800
# SUPPLEMENTARY CONDITIONS

## PART 1 GENERAL

### 1.01 SUMMARY

**1.02 These Supplementary Conditions amend and supplement the General Conditions defined in Document 00700 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.**

**1.03 The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.**

### 1.04 MODIFICATIONS TO GENERAL CONDITIONS

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

## MODIFICATIONS TO AIA A201

### 4.01 ARTICLE 2.2 - INFORMATION AND SERVICES REQUIRED OF THE OWNER

### 4.02 ARTICLE 3.18 - INDEMNIFICATION

A. Article 3.18.1 - The first sentence is amended to read as follows: To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's Consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's 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 or destruction to tangible property (other than the Work itself ) including loss of use resulting there from, but only to the extent caused in whole or in part by negligent reckless or intentional acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a part indemnified hereunder.

### 4.03 ARTICLE 11.3 - PROPERTY INSURANCE

A. Amend Article 11.3.1 as follows:
   1. The Contractor is to effect and maintain property insurance provided in this article as the interest of the Owner and Contractor may appear. Said insurance in a company or companies which the owner has no reasonable objection, is to include coverage for damage resulting from vandalism, theft, and malicious mischief in the amount of 100% of the contract amount.

**END OF DOCUMENT**

# SECTION 01100

# SUMMARY

## PART 1 GENERAL

### 1.01 PROJECT

A. Project Name: ST. PAUL CATHOLIC CHURCH PARISH LIFE CENTER.

B. Owner's Name: ST. PAUL CATHOLIC CHURCH.

C. Owner’s Contact Agent: MR. KYLE BALTZ.

D. Architect's Name: MATT SILAS ARCHITECT.

E. The Project consists of site demolition, new building construction and paving.

### 1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00500 - Agreement.

### 1.03 WORK BY OWNER

A. None.

### 1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to Construction Site.

B. Provide access to and from site as required by law and by the Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Utility Outages and Shutdown:
   1. Prevent accidental disruption of utility services to adjacent properties.

D. Restroom Facilities:

   1. The Contractor shall be responsible for providing restroom facilities for workers employed by the Contractor. Use of existing facilities is prohibited.

### 1.06 WORK SEQUENCE

A. Construct Work best suited to meet the allotted construction period.

### 1.07 ROLE OF ARCHITECT

A. The Architect, Matt Silas Architect, is providing construction documents and contract administration including construction administration. All questions and submissions to be directed to the Architect.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01200

# PRICE AND PAYMENT PROCEDURES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

### 1.02 SCHEDULE OF VALUES

A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Matt Silas Architect for approval.

B. Forms filled out by hand will not be accepted.

C. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

E. Revise schedule to list approved Change Orders, with each Application For Payment.

### 1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Matt Silas Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Present required information in typewritten form.

E. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

I. Submit three copies of each Application for Payment.

J. Include the following with the application:
   1. Construction progress schedule, revised and current as specified in Section 01300.
   2. Affidavits attesting to off-site stored products.

K. When Matt Silas Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

### 1.04 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Matt Silas Architect will issue instructions directly to the Owner and Contractor.

B. Matt Silas Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on AIA Form G710.

C. For other required changes, Matt Silas Architect will issue a document signed by the Owner instructing to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

D. For changes for which advance pricing is desired, Matt Silas Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. shall prepare and submit a fixed price quotation within 10 days.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by the Owner, the amount will be based on the Contractor's request for a Change Order as approved by Matt Silas Architect.

F. Execution of Change Orders: Matt Silas Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

G. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

H. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

### 1.05 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01700.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01210

# ALLOWANCES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Cash Allowances.

### 1.02 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to subcontractor, delivery to site, installation and applicable taxes.

### 1.03 ALLOWANCE SCHEDULE

A. Audio – Video – Lighting (AVL) package to include the following for an amount of **$65,000.00**:

1. (2) Main speakers, (2) subs and (2) monitor speakers along with mounting devices;
2. Custom floor pockets for connections at stage;
3. (1) mixing console;
4. Wireless microphones;
5. LED based production lighting with front and back positions;
6. Lighting console and data distribution;
7. (2) projection screens and (2) projectors

B. Special Inspections and Testing as indicated in Construction Documents and required by the Building Code: **$15,000.00.**

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01300

# ADMINISTRATIVE REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Progress meetings.

B. Construction progress schedule.

C. Submittals for review, information, and project closeout.

D. Number of copies of submittals.

E. Submittal procedures.

### 1.02 RELATED REQUIREMENTS

A. Document 00700 - General Conditions: Dates for applications for payment.

B. Section 01325 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01700 - Execution Requirements: Additional coordination requirements.

D. Section 01780 - Closeout Submittals: Project record documents.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PRECONSTRUCTION MEETING

A. The Owner will schedule a meeting after Notice of Award if required.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner - Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, schedule of values, and progress schedule.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Matt Silas Architect, the Owner, participants, and those affected by decisions made.

### 3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, the Owner, and Matt Silas Architect.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Matt Silas Architect, the Owner, participants, and those affected by decisions made.

**3.03 CONSTRUCTION PROGRESS SCHEDULE**

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit updated schedule with each Application for Payment.

**3.04 SUBMITTALS FOR REVIEW**

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Matt Silas Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01780 - CLOSEOUT SUBMITTALS.

**3.05 SUBMITTALS FOR INFORMATION**

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit (2) copies to the Architect for record and for compliance of specified products in

addition to the number of copies needed from the supplier / vendor.

### 3.06 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

### 3.07 NUMBER OF COPIES OF SUBMITTALS

A. Documents for Review:
   1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches (215 x 280 mm): Submit the number of copies which the submitter requires, plus two copies which will be retained by the Matt Silas Architect.
   2. Larger Sheets, Not Larger Than 36 x 48 inches (910 x 1220 mm): Submit the number of opaque reproductions which the submitter requires, plus two copies which will be retained by Matt Silas Architect.

B. Documents for Information: Submit two copies.

C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Matt Silas Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to unless specifically so stated.

### 3.08 SUBMITTAL PROCEDURES

A. Transmit each submittal with AIA Form G810.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project,, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Deliver submittals to Matt Silas Architect at business address.

F. Schedule submittals to expedite the Project, and coordinate submission of related items.

G. For each submittal for review, allow 15 days excluding delivery time to and from the.

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

I. Provide space for Contractor and Matt Silas Architect review stamps.

J. When revised for resubmission, identify all changes made since previous submission.

K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

L. Submittals not requested will not be recognized or processed.

**END OF SECTION**

# SECTION 01325

# CONSTRUCTION PROGRESS SCHEDULE

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

### 1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit the number of opaque reproductions that requires, plus two copies that will be retained by Matt Silas Architect.

G. Submit under transmittal letter form specified in Section 01300.

### 1.03 QUALITY ASSURANCE

A. Scheduler:'s personnel or specialist Consultant specializing in CPM scheduling with one year minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

### 1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm) or width required.

C. Scale and Spacing: To allow for notations and revisions.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

### 3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Include conferences and meetings in schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work

completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Matt Silas Architect. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for owner-furnished products.

H. Provide legend for symbols and abbreviations used.

**3.03 BAR CHARTS**

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

A. Participate in joint review and evaluation of schedule with Matt Silas Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

**3.05 UPDATING SCHEDULE**

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

**3.06 DISTRIBUTION OF SCHEDULE**

A. Distribute copies of updated schedules to project site file, to Subcontractors, suppliers, Matt Silas Architect, the Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

**END OF SECTION**

# SECTION 01400

# QUALITY REQUIREMENTS

## PART 1 GENERAL

### 1.01 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance, quality control, and IBC required special inspections**.**

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

### 1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

### 1.03 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. 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 tests or inspections.
5. Names of individuals making tests 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 results.
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 retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, 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.

**1.04 QUALITY ASSURANCE**

A. 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.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer 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.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work 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.

D. 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.

E. 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.

F. Testing Agency Qualifications: An agency with the 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.

G. Pre-Construction Testing: Testing agency shall perform pre-construction testing for compliance with specified requirements for performance and test methods.
   1. Contractor responsibilities include the following:
      a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
      d. When testing is complete, remove assemblies; do not reuse materials on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests

and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

**1.05 QUALITY CONTROL**

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will employ and pay for 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 description 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, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Quality Assurance and Control of Installation: Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
      a. Comply fully with manufacturers' instructions.
      b. Comply with specified standards as a minimum quality level for the Work, except when more stringent tolerances, code requirements, or other specified requirements indicate higher standards or more precise workmanship.
      c. Tolerances: Monitor tolerance control of product installation to assure acceptable work. Do not permit tolerance margins to accumulate and result in non-conforming work.
         1) Comply with specified, referenced, and/or manufacturers' tolerances, whichever is most restrictive.
         2) Adjust products to appropriate dimensions and position before securing in place.
   2. Quality Control and Testing Services: Where testing services are indicated as Contractor's responsibility, engage and pay for 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.
      b. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
      c. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
      d. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
      e. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Special Tests and Inspections: Owner will engage and pay for 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 its 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.
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.

D. 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.

E. Retesting / Re-Inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as 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 tests 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 material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities 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. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

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

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

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### 3.02 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Matt Silas Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.03 TESTING AND INSPECTION

A. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with Matt Silas Architect and in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Matt Silas Architect and of observed irregularities or non-conformance of Work or products.
5. Perform additional tests and inspections required by Matt Silas Architect.
6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of.
4. Agency has no authority to stop the Work.

C. Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.
    d. To provide storage and curing of test samples.
4. Notify Matt Silas Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by beyond specified requirements.
6. Arrange with the Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Matt Silas Architect.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by.

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Matt Silas Architect. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Sum.

### 3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Matt Silas Architect, it is not practical to remove and replace the Work, Matt Silas Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

# SECTION 01410

# REGULATORY REQUIREMENTS

## PART 1 GENERAL

### 1.01 SUMMARY

A. Regulatory requirements applicable to this project are the following:

1. 29 CFR 1910 - Occupational Safety and Health Standards; current edition; as a work place.
2. ARKANSAS FIRE PREVENTION CODE 2012 (AFPC) – VOLUMES I AND II.
3. NFPA 101 - Life Safety Code, 2003.
4. Plumbing Code: Arkansas, 2006.
5. Mechanical Code: Arkansas, 2010.
6. Fuel Gas Code: Arkansas, 2006.
7. National Electrical Code, 2014
8. Energy Code: 2014 Arkansas Energy Code.
9. Existing Building Code: ICC International Existing Building Code, 2012.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01422

# DEFINITIONS

## PART 1 GENERAL

### 1.01 SUMMARY

A. Other definitions are included in individual specification sections.

### 1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01453
# CODE-REQUIRED SPECIAL INSPECTIONS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

D. Manufacturers' field services.

E. Fabricators' field services.

### 1.02 DEFINITIONS

A. Code or Building Code: 2012 Edition Arkansas Fire Prevention Code, (based on 2012 International Building Code) and, more specifically, Chapter 17 - Structural Tests and Inspections, of same.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspection:
   1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved contract documents and the referenced standards.
   2. Special inspections are separate from and independent of tests and inspections conducted by the Owner or General Contractor for the purposes of quality assurance and contract administration.

### 1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

B. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; 2011.

C. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2010.

D. AISC 360 - Specification for Structural Steel Buildings; 2010.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2013.

F. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2012.

G. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2010.

H. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

I. ASTM E329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2011.

J. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2009

K. AWCI 125 - Technical Manual 12-B: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistance Materials; 1998.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2010.

M. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

N. IAS AC291 - Accreditation Criteria for Special Inspection Agencies; 2012.

**1.04 SUBMITTALS**

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency shall:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.

C. Smoke Control Testing Agency Qualifications: Prior to the start of work, the Testing Agency shall:
   1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit documentary evidence that agency has appropriate credentials and documented experience in fire protection engineering, mechanical engineering and HVAC air balancing.
   3. Submit certification that Testing Agency is acceptable to AHJ.

D. Manufacturer's Qualification Statement: Manufacturer shall submit documentation of manufacturing capability and quality control procedures.

E. Fabricator's Qualification Statement: Fabricator shall submit documentation of fabrication facilities and methods as well as quality control procedures.

F. Special Inspection Reports: After each special inspection, Special Inspector shall promptly submit two copies of report; one to the Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Conformance with Contract Documents.
   2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

G. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector shall promptly submit two copies of report; one to the Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of fabricated item and specification section.
      f. Location in the Project.
      g. Results of special inspection.
      h. Verification of fabrication and quality control procedures.
      i. Conformance with Contract Documents.
      j. Conformance to referenced standard(s).

H. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to the Architect and AHJ, in quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to the Architect and AHJ.

I. Manufacturer's Field Reports: Submit reports to the Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to the Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

J. Fabricator's Field Reports: Submit reports to the Architect and AHJ.
1. Submit report in duplicate within 30 days of observation to the Architect for information.
2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

**1.05 SPECIAL INSPECTION AGENCY**

A. The Contractor will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling required by the building code.

B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

C. Employment of agency in no way relieves the Contractor of obligation to perform work in accordance with requirements of Contract Documents.

**1.06 TESTING AND INSPECTION AGENCIES**

**1.07 QUALITY ASSURANCE**

A. Special Inspection Agency Qualifications:
1. Independent firm specializing in performing testing and inspections of the type specified in this section.
2. Accredited by IAS according to IAS AC291.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL**

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

**3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION**

A. High-Strength Bolt, Nut and Washer Material:
1. Verify identification markings conform to ASTM standards specified in the approved contract and to AISC 360, A3.3; periodic.
2. Submit manufacturer's certificates of compliance; periodic.

B. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
1. Snug tight joints; periodic.

C. Weld Filler Material:
1. Verify identification markings conform to AWS standards specified in the approved contract documents and to AISC 360, A3.5; periodic.
2. Submit manufacturer's certificates of compliance; periodic.

D. Welding:
1. Reinforcing Steel: Verify items listed below comply with AWS D1.4 and ACI 318, Section 3.5.2.
a. Verification of weldability; periodic.

b. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames as well as boundary elements of special structural walls of concrete and shear reinforcement; continuous.
c. Shear reinforcement; continuous.
d. Other reinforcing steel; periodic.

E. Steel Frame Joint Details: Verify compliance with approved contract documents.
1. Details, bracing and stiffening; periodic.
2. Member locations; periodic.
3. Application of joint details at each connection; periodic.

**3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION**

A. Reinforcing Steel, Including Pre-stressing of Tendons and Placement: Verify compliance with approved contract documents and ACI 318, 3.5 and 7.1 through 7.7; periodic.

B. Reinforcing Steel Welding: Verify compliance with AWS D1.4 and ACI 318, 3.5.2; periodic.

C. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved contract documents and ACI 318, 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

D. Anchors Installed in Hardened Concrete: Verify compliance with ACI 318, 3.8.6, 8.1.3 and 21.2.8; periodic.

E. Design Mix: Verify plastic concrete complies with the design mix in approved contract documents and with ACI 318, Chapter 4 and 5.2; periodic.

F. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172, ASTM C31 and ACI 318, 5.6 and 5.8 and record the following, continuous:
1. Slump.
2. Air content.
3. Temperature of concrete.

G. Concrete and Shotcrete Placement: Verify application techniques comply with approved contract documents and ACI 318, 5.9 and 5.10; continuous.

H. Specified Curing Temperature and Techniques: Verify compliance with approved contract documents and ACI 318, 5.11 through 5.13; periodic.

I. Concrete Strength in Situ: Verify concrete strength complies with approved contract documents and ACI 318, 6.2, for the following.

J. Formwork Shape, Location and Dimensions: Verify compliance with approved contract documents and ACI 318, 6.1.1; periodic.

K. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials conform to the quality standards of ACI 318, the AHJ will require that the Special Inspector verify compliance with the appropriate standards and criteria in ACI 318, Chapter 3.

**3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION**

A. Masonry Structures Subject to Special Inspection:
1. Empirically designed masonry, glass unit masonry and masonry veneer in structures designated as "essential facilities".
2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved contract documents and the applicable articles of ACI 530/530.1/ERTA.
1. Inspections and Approvals:
a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
b. Verify approval of submittals required by contract documents; periodic.
2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.

3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self-consolidating grout arrives on site; continuous.
4. Joints and Accessories: When masonry construction begins, verify:
   a. Proportions of site prepared mortar; periodic.
   b. Construction of mortar joints; periodic.
   c. Location of reinforcement, connectors, pre-stressing tendons, anchorages, etc.; periodic.
5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
   a. Size and location of structural elements; periodic.
   b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
   c. Size, grade and type of reinforcement, anchor bolts and pre-stressing tendons and anchorages; periodic.
   d. Welding of reinforcing bars; continuous.

C. Engineered Masonry in Buildings Designated as "Essential Facilities": Verify compliance of each item below with approved contract documents and the applicable articles of ACI 530/ASCE 5/TMS 402.
1. Inspections and Approvals:
   a. Verify compliance with the required inspection provisions of the approved contract documents; periodic.
   b. Verify approval of submittals required by contract documents; periodic.
2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction and upon completion of each 5,000 square feet increment of masonry erected during construction; periodic.
3. Pre-blended Mortar and Grout: Verify proportions of materials upon delivery to site; periodic.
4. Slump Flow and Visual Stability Index (VSI): Verify compliance as self-consolidating grout arrives on site; continuous.
5. Engineered Elements, Joints, Anchors, Grouting, Protection: Verify compliance of each item below with approved contract documents and referenced standards.
   a. Proportions of site prepared mortar; periodic.
   b. Placement of masonry units and construction of mortar joints; periodic.
   c. Placement of reinforcement, connectors, pre-stressing tendons, anchorages, etc.; periodic.
   d. Size and location of structural elements; periodic.
   e. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; continuous.
   f. Size, grade and type of reinforcement, anchor bolts and pre-stressing tendons and anchorages; periodic.
   g. Welding of reinforcing bars; continuous.
6. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; continuous.

### 3.05 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
1. Design bearing capacity of material below shallow foundations; periodic.
2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
4. Subgrade, prior to placement of compacted fill; periodic.

B. Testing: Classify and test excavated material; periodic.

### 3.06 SPECIAL INSPECTIONS FOR SMOKE CONTROL

A. Test smoke control systems as follows:
1. Record device locations and test system for leakage after erection of ductwork but before starting construction that conceals or blocks access to system.
2. Test and record pressure difference, flow measurements, detection function and controls after system is complete and before structure is occupied.

### 3.07 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

A. Structural Steel: Comply with the quality assurance plan requirements of AISC 341.

B. Cold Formed Steel Light Frame Construction:
   1. Field welding; periodic.
   2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.

C. Architectural Components: Erection and fastening of components below; periodic.
   1. Exterior cladding.
   2. Interior and exterior veneer.
   3. Interior and exterior non-loadbearing walls and partitions.

D. Mechanical and Electrical Components:
   1. Anchorage of electric equipment required for emergency or standby power systems; periodic.
   2. Installation and anchorage of other electrical equipment; periodic.
   3. Vibration isolation systems where the approved contract documents require a nominal clearance of 1/4 inch or less between support frame and seismic restraint; periodic.

E. Designated Seismic System Verification: Verify label, anchorage or mounting conforms to certificate of compliance provided by manufacturer or fabricator.

F. Seismic Isolation System:
   1. Fabrication and installation of isolator units; periodic.
   2. Fabrication and isolation of energy dissipation devices; periodic.

G. Structural Testing for Seismic Resistance:
   1. Concrete reinforcement: Comply with ACI 318, Section 21.1.5.2.
      a. Materials Obtain mill certificates demonstrating compliance with ASTM A615/A615M; periodic.
      b. Welding: Perform chemical tests complying with ACI 318, Section 3.5.2 to determine weldability; periodic.
   2. Structural Steel: Comply with the quality assurance requirements of AISC 341.
   3. Non-Structural Components:
      a. General Design Requirements: Obtain manufacturer certification of compliance with requirements of ASCE 7, Section 13.2.1; periodic.
      b. Designated Seismic Force-Resisting Non-Structural System Components: Obtain manufacturer certification of compliance with ASCE 7, Section 13.2.2; periodic.

H. Structural Observations for Seismic Resistance: Visually observe structural system for general conformance with the approved contract documents; periodic.

### 3.08 SPECIAL INSPECTIONS FOR WIND RESISTANCE

A. Cold Formed Steel Light Frame Construction:
   1. Field welding; periodic.
   2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic

B. Wind Resisting Components:
   1. Roof cladding; periodic.
   2. Wall cladding; periodic.

C. Structural Observations for Wind Resistance: Visually observe structural system for general conformance with the approved contract documents; periodic.

### 3.09 OTHER SPECIAL INSPECTIONS

A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.

B. For the purposes of this section, work unusual in nature includes, but is not limited to:
   1. Construction materials and systems that are alternatives to materials and systems prescribed by the building code.
   2. Unusual design applications of materials described in the building code.

3. Materials and systems required to be installed in accordance with the manufacturer's instructions when said instructions prescribe requirements not included in the building code or in standards referenced by the building code.

C. Alternative Test Procedures: Where approved rules and standards do not exist, test materials and assemblies as required by AHJ or provide AHJ with documentation of quality and manner in which those materials and assemblies are used.

D. Load Tests:
1. Proposed Construction and Construction in Progress: Where required by code, conduct tests listed below.
a. Load test procedures specified in code; periodic.
b. Loadbearing Wall and Partition Assemblies: Load test with and without window framing; periodic.
c. Exterior Window and Door Assemblies: Wind load design pressure test; periodic.
2. Completed Construction: Where required by code, conduct tests listed below.
a. Load test procedures specified in code; periodic.

## 3.10 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
1. Verify samples submitted by the Contractor comply with the referenced standards and the approved contract documents.
2. Provide qualified personnel at site. Cooperate with the Architect and the Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified reference standards.
4. Ascertain compliance of materials and products with requirements of Contract Documents.
5. Promptly notify the Architect and the Contractor of observed irregularities or non-conformance of work or products.
6. Perform additional tests and inspections required by the Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests or inspections specified.

B. Limits on Special Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of the Contractor.
4. Agency has no authority to stop the work.

C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by the Architect.

D. Re-testing required because of non-conformance to specified requirements shall be paid for by the Contractor.

## 3.11 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with the Architect and the Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify the Architect and the Contractor of observed irregularities or non-conformance of work or products.
5. Perform additional tests and inspections required by the Architect.
6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of the Contractor.

4. Agency has no authority to stop the work.

C. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions the Architect.

D. Re-testing required because of non-conformance to specified requirements shall be paid for by the Contractor.

### 3.12 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. The Contractor's Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
a. To provide access to work to be tested or inspected.
b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
c. To facilitate tests or inspections.
d. To provide storage and curing of test samples.
4. Notify the Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
5. Arrange with the Owner's agency and pay for additional samples, tests, and inspections required by the Contractors beyond specified requirements.

B. The Contractor's Responsibilities, Wind Force-Resisting Systems: Submit written statement of responsibility for each item listed to AHJ and the Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

### 3.13 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to the Architect 30 days in advance of required observations.
1. Observer subject to approval of the Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.14 SCHEDULE OF SPECIAL INSPECTIONS - GENERAL

A. **Contractor shall obtain (download) copy of Structural Engineers Association of Arkansas document titled "Arkansas Special Inspections Guidelines" dated January 01, 2014 for comprehensive special inspections instructions and requirements, and contract forms required for documentation. (Document: SEAoAR SI GL 02 - 01/01/2014)**

B. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
1. Continuous Special Inspection: Special Inspection Agency shall be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency shall be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

### 3.15 SCHEDULE OF SPECIAL INSPECTIONS - SPECIFIC

A. **1704.2.5 Inspection of Fabricators**
1. Verify fabrication/quality control procedures.
a. Service: In-plant review (3)
1) *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
b. Extent: Periodic

c. Agent: Special Inspections Agency

B. **1705.2 Structural Steel Construction**

1. Review the material test reports and certificates as listed in AISC 360-10, Section N3.2 for compliance with the construction documents.
   a. Service: Submittal review
   b. Extent: Each submittal
   c. Agent: Special Inspections Agency
2. Material verification of structural steel
   a. Service: Shop (3) and field inspection
      1) *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
3. Anchor Rods and other Embedment(s) (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)
   a. Service: Field inspection
   b. Extent: Continuous
   c. Agent: Special Inspections Agency
4. (4) Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents.
   a. Service: Field inspection
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
5. Structural steel welding:
   a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)
      1) Service: Shop (3) and field inspection
         (a) *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      2) Extent: Observe or Perform as noted (4)
         (a) *(4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.*
      3) Agent: Special Inspections Agency
   b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)
      1) Service: Shop (3) and field inspection
         (a) (3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)
      2) Extent: Observe (4)
         (a) (4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.
      3) Agent: Special Inspections Agency
   c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)
      1) Service: Shop (3) and field inspection
         (a) (3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)
      2) Extent: Observe or Perform as noted (4)
         (a) (4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.
      3) Agent: Special Inspections Agency

d. Nondestructive testing (NDT) of welded joints: See Commentary
   1) (1) Complete penetration groove welds at joints in materials 5/16" or greater in Risk Category III or IV.
      (a) Service: Shop (3) or field ultrasonic testing - 100%
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      (b) Extent: Periodic
      (c) Agent: Special Inspections Agency
   2) (2) Complete penetration groove welds at joints in materials 5/16" or greater in Risk Category II
      (a) Service: Shop (3) or field ultrasonic testing - 10% of welds minimum
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      (b) Extent: Periodic
      (c) Agent: Special Inspections Agency
   3) (3) Thermally cut surfaces of access holes when material t > 2"
      (a) Service: Shop (3) or field magnetic Particle or Penetrant testing
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      (b) Extent: Periodic
      (c) Agent: Special Inspections Agency
   4) (4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1
      (a) Service: Shop (3) or field radiographic or Ultrasonic testing
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      (b) Extent: Periodic
      (c) Agent: Special Inspections Agency
   5) (5) Fabricator's NDT reports when fabricator performs NDT
      (a) Service: Verify reports
      (b) Extent: Each Submittal (5)
      *(5) NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N7.*
      (c) Agent: Structural Engineer

6. Structural steel bolting: Service - Shop (3) and field Inspection.
   a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360- 10, Table N5.6-1)
      1) Service: n/a
      2) Observe (4)
      3) Agent: Special Inspections Agency

   b. NA
   c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)
      (1) Service: n/a
      (2) Extent: Perform (4)
      (3) *(4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.*
      (4) Agent: Special Inspections Agency

C. **1705.3 Concrete Construction**
1. Inspection of reinforcing steel placement
   a. Service: Field inspection
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
2. NA
3. Inspection of anchors cast in concrete where allowable loads have been increased or where strength design is used
   a. Service: Shop (3) and field inspection
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Continuous
   c. Agent: Special Inspections Agency
4. NA.
5. Verify use of approved design mix
   a. Service: Shop (3) and field inspection
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Periodic
   c. Agent: Structural Engineer
6. Fresh concrete sampling, perform slump and air content tests and determine temperature of concrete
   a. Service: Shop (3) and field inspection
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Continuous
   c. Agent: Special Inspections Agency and Manufacturer
7. Inspection of concrete placement for proper application techniques.
   a. Service: Shop (3) and field inspection
   b. Extent: Continuous
   c. Agent: Special Inspections Agency
8. Inspection for maintenance of specified curing temperature and techniques
   a. Service: Shop (3) and field inspection
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
9. NA
10. NA
11. NA
12. NA
13. Concrete strength testing and verification of compliance with construction documents
   a. Service: Field testing and review of laboratory reports
   b. Extent: Periodic
   c. Agent: Special Inspections Agency

D. **1705.4 Masonry Construction**
1. **(A) Level A, B and C Quality Assurance:**
   a. (1) Verify compliance with approved submittals
      1) Service: Field inspection
      2) Extent: Periodic
      3) Agent: Structural Engineer

E. **1705.6 Soils**
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.
   a. Service: Field inspection

b. Extent: Periodic
c. Agent: Special Inspections Agency

2. Verify excavations are extended to proper depth and have reached proper material.
   a. Service: Field inspection
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
3. Perform classification and testing of controlled fill materials.
   a. Service: Field inspection
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of compacted fill
   a. Service: Field inspection
   b. Extent: Continuous
   c. Agent: Special Inspections Agency
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly
   a. Service: Field inspection
   b. Extent: Periodic
   c. Agent: Special Inspections Agency

F. **1705.10.3 Wind-resisting Components**

1. Roof cladding
   a. Service: Shop (3) and field inspection
      1) (3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)
   b. Extent: Periodic
   c. Agent: Architect
2. Wall cladding
   a. Service: Shop (3) and field inspection
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Periodic
   c. Agent: Architect

G. **1705.11.1 Structural Steel Special Inspections for Seismic Resistance**

1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 341-10,Section J2 for compliance with construction documents)
   a. Service: Submittal Review
   b. Extent: Each submittal
   c. Agent: Structural Engineer
2. Structural steel welding:
   a. Inspection tasks Prior to, During and After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 341-10, Table J6-1, J6-2 & J6-3)
      1) Service: Shop (3) and field inspection
         *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      2) Extent: Observe or perform as noted (4)
         *(4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.*
      3) Agent: Special Inspections Agency
   b. Nondestructive testing (NDT) of welded joints in accordance with AISC 341-10, Section J6.2
      1) Service: Shop (3) and field testing
         *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*

2) Extent: Periodic
3) Agent: Special Inspections Agency

3. Structural steel bolting:
   a. Inspection tasks Prior to, During and After Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 341-10, Table J7-1, J7-2 & J7-3)
      1) Service: Shop (3) and field inspections
         *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      2) Extent: Observe or perform as noted (4)
         *(4) Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.*
      3) Agent: Special Inspections Agency

H. **1705.11.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance**
   1. (2) Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system Shop (3) and field inspection
      a. Required this Project: <YES>
      b. Service: Shop (3) and field testing
         *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
      c. Extent: Periodic
      d. Agent: Special Inspections Agency

I. **1705.11.4 Designated Seismic System Verification**
   0. Inspect and verify that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with 1705.12.3
      a. Service: Field inspection
      b. Extent: Continuous
      c. Agent: Special Inspections Agency
   1. Architectural Designated Seismic Systems (per ASCE 7-10)
      a. Interior non-structural partition walls and connections
         1) Service: Field inspection
         2) Extent: Periodic
         3) Agent: Architect
      b. Parapets – NA
      c. Chimneys – NA
      d. Exterior non-structural walls elements and connections
         1) Service: Field inspection
         2) Extent: Periodic
         3) Agent: Architect
      e. Veneer
         1) Service: Field inspection
         2) Extent: Periodic
         3) Agent: Architect
      f. Suspended Ceiling Systems
         1) Service: Field inspection
         2) Extent: Periodic
         3) Agent: Architect
      g. Cabinets
         1) Service: Field inspection
         2) Extent: Periodic
         3) Agent: Architect

h. Storefront and curtainwall framing
   1) Service: Field inspection
   2) Extent: Periodic
   3) Agent: Architect
i. Access Floors - NA
j. Glass in glazed interior and exterior storefront and curtainwall systems
   1) Service: Field inspection
   2) Extent: Periodic
   3) Agent: Architect

2. Mechanical & Electrical Designated Seismic Systems (per ASCE 7-10)
   a. Mechanical and Electrical Components
      1) Air-side HVAC fans, air handlers, air conditioning units, air distribution boxes, and other mechanical components constructed of sheet metal
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Mechanical Engineer
      2) Wet side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, air separators, manufacturing or process equipment and other mechanical components constructed of high- deformability materials.
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Mechanical Engineer
      3) Engines, turbines, pumps, compressors, and pressure vessels
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Mechanical Engineer
      4) NA
      5) NA
      6) Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Electrical Engineer
      7) Communication equipment, computers, instrumentation and controls
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Electrical Engineer
      8) NA
      9) Light fixtures
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Electrical Engineer
   b. Vibration Isolated Components & Systems
      1) Components and systems isolated using neoprene elements and neoprene isolated floors with built-in or separate elastomeric snubbing devices or resilient perimeter stops
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Mechanical Engineer
      2) Spring isolated components and systems closely restrained using built in or separate elastomeric snubbing devices or resilient perimeter stops
         (a) Service: Field inspection
         (b) Extent: Periodic
         (c) Agent: Mechanical Engineer
      3) Internally isolated systems and supports
         (a) Service: Field inspection
         (b) Extent: Periodic

(c) Agent: Mechanical Engineer

4) Suspended vibration isolation equipment including in-line duct devices and suspended internally isolated components
   (a) Service: Field inspection
   (b) Extent: Periodic
   (c) Agent: Mechanical Engineer

c. Distribution Systems
   1) Piping and tubing including in-line components
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Mechanical Engineer
   2) Ductwork, including in–line components
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Mechanical Engineer
   3) Electrical conduit and cable trays
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Electrical Engineer
   4) Bus ducts
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Electrical Engineer
   5) Plumbing
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Mechanical Engineer
   6) NA
   7) Fire Protection Sprinkler Pipe System
      (a) Service: Field inspection
      (b) Extent: Periodic
      (c) Agent: Mechanical Engineer

J. **1705.11.5 Architectural Components Special Inspections for Seismic Resistance**
   1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer.
      a. Service: Field inspection
      b. Extent: Periodic
      c. Agent: Architect
   2. Inspection during the erection and fastening of interior and exterior non load bearing walls.
      a. Service: Field inspection
      b. Extent: Periodic
      c. Agent: Architect

K. **1705.11.6 Mechanical and Electrical Components Special Inspections for Seismic Resistance**
   1. Inspection during the anchorage of electrical equipment for emergency or standby power systems.
      a. Service: Field inspection
      b. Extent: Periodic
      c. Agent: Electrical Engineer
   2. Inspection during the anchorage of other electrical equipment.
      a. Service: Field inspection
      b. Extent: Periodic
      c. Agent: Electrical Engineer
   3. (5) Inspection during the installation and anchorage of vibration isolation systems.
      a. Service: Field inspection
      b. Extent: Periodic
      c. Agent: Mechanical Engineer

L. **1705.12.1 Concrete Reinforcement Testing and Qualification for Seismic Resistance**
1. Review certified mill test reports
   a. Service: Field review
   b. Extent: Each shipment
   c. Agent: Special Inspections Agency

M. **1705.12.2 Structural Steel Testing and Qualification for Seismic Resistance**
1. Test in accordance with the quality assurance requirements of AISC 341-10
   a. Service: Shop (3) and field testing
      *(3) Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.2)*
   b. Extent: Per AISC 341
   c. Agent: Special Inspections Agency

N. **1705.12.3 Seismic Certification of Nonstructural Components**
1. Review certificate of compliance for designated seismic system components.
   a. Service: Certificate of compliance review
   b. Extent: Each submittal
   c. Agent: Architect

O. **1705.15 Exterior insulation and finish Systems (EIFS)**
1. Verify materials, details and installations are per approved construction documents.
   a. Service: Field Inspection.
   b. Extent: Periodic
   c. Agent: Architect

P. **1705.17 Smoke Control Systems**
1. (1) Leakage testing and recording of device locations prior to concealment.
   a. Service: Field testing
   b. Extent: Periodic
   c. Agent: Special Inspections Agency
2. (2) Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements and detection and control verification.
   a. Service: Field testing
   b. Extent: Periodic
   c. Agent: Special Inspections Agency

**END OF SECTION**

# SECTION 01500

# TEMPORARY FACILITIES AND CONTROLS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telephone service.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers and enclosures.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

### 1.02 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

### 1.03 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures at rear exterior of building outside of loading dock in northwest corner. Provide at time of project mobilization.

B. Use of existing facilities located at the basement level is permitted during the initial phase of construction. Basement level facilities will not be available once construction starts n this space.

C. Maintain daily in clean and sanitary condition.

### 1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way when required.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

### 1.05 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

### 1.06 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and the Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide temporary parking areas to accommodate construction personnel.

### 1.07 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

### 1.08 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

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

C. Restore existing facilities used during construction to original condition.

D. Restore new permanent facilities used during construction to specified condition.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01585

# PROJECT SIGNS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project identification sign.

### 1.02 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

## PART 2 PRODUCTS

### 2.01 SIGN MATERIALS

A. Structure and Framing: New, metal or other durable material, structurally adequate.

### 2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign, 32 sq ft area, bottom 3 feet above ground where designated by the owner and architect. No other project signs shall be allowed or displayed. Individual company signs from contractor, subcontractor, and other entities are not allowed.

B. Content:
   1. Project title, logo and name of the project as indicated on Contract Documents and supplied by the owner.
   2. Names, logos and titles of Matt Silas Architect and Consultants.
   3. Name of Prime Contractor.
   4. Financial Institution when applicable.
   5. Rendering.

C. Graphic Design, Colors, Style of Lettering: Designated by Matt Silas Architect.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location of high public visibility adjacent to main entrance to site. Coordinate sign type and location prior to ordering and installation.

C. Install sign surface plumb and level, with butt joints. Anchor securely.

### 3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

### 3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

**END OF SECTION**

# SECTION 01600

# PRODUCT REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

### 1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

## PART 2 PRODUCTS

### 2.01 EXISTING PRODUCTS

A. Unforeseen historic items encountered remain the property of the Owner; notify the Owner promptly upon discovery; protect, remove, handle, and store as directed by the Owner.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the contractor if allowed by the owner; remove from site after owner verification.

C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

### 2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. Do not use products having any of the following characteristics:
   1. Made using or containing CFC's or HCFC's.

C. Urea-Formaldehyde Prohibition:

1. Overall Project Requirement: Provide composite wood and agri-fiber products having no added urea-formaldehyde resins.
   a. Require each installer to certify compliance and submit product data showing product content.
2. Specific Product Categories: Comply with limitations specified elsewhere.

D. Provide interchangeable components of the same manufacture for components being replaced.

E. Motors: Refer to Section 15065, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

F. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

G. Cord and Plug: Provide minimum 6 foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

**2.03 PRODUCT OPTIONS**

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

**2.04 MAINTENANCE MATERIALS**

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

**PART 3 EXECUTION**

**3.01 SUBSTITUTION PROCEDURES**

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. A request for substitution constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the substitution as for the specified product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to the Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.

D. Substitution Submittal Procedure:
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The Matt Silas Architect will notify in writing of decision to accept or reject request.

### 3.02 OWNER-SUPPLIED PRODUCTS

A. See Section 01100 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:
   1. Arrange and pay for product delivery to site.
   2. On delivery, inspect products jointly with the contractor.
   3. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   4. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with the Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

### 3.03 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

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

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### 3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement,

or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

# SECTION 01616

# VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. VOC restrictions for product categories listed below under "DEFINITIONS."

B. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

### 1.02 DEFINITIONS

A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
   1. Adhesives, sealants, and sealer coatings.
   2. Carpet.
   3. Carpet cushion.
   4. Carpet tile.
   5. Resilient floor coverings.
   6. Wood flooring.
   7. Paints and coatings.
   8. Insulation.
   9. Gypsum board.
   10. Acoustical ceilings and panels.
   11. Cabinet work.

B. Interior of Building: Anywhere inside the exterior weather barrier.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.

D. Installer Certifications for Accessory Materials: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of his products, or 2) that such products used comply with these requirements.

### 1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
   1. Evidence of Compliance: Acceptable types of evidence are:

a. Report of laboratory testing performed in accordance with requirements.

B. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
1. Evidence of Compliance: Acceptable types of evidence are:
a. Current GreenSeal Certification.

C. Paints and Coatings: Provide products having VOC content as specified in Section 09900.

D. Carpet and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
1. Evidence of Compliance: Acceptable types of evidence are:
a. Current Green Label Plus Certification.
b. Report of laboratory testing performed in accordance with requirements.

E. Carpet Tile and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
1. Evidence of Compliance: Acceptable types of evidence are:
a. Current Green Label Plus Certification.
b. Report of laboratory testing performed in accordance with requirements.

## PART 3 EXECUTION

### 3.01 FIELD QUALITY CONTROL

A. The Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to the owner.

B. All additional costs to restore indoor air quality due to installation of non-compliant products will be borne by.

**END OF SECTION**

# SECTION 01700

# EXECUTION REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of the Owner’s personnel.

H. Closeout procedures, except payment procedures.

I. General requirements for maintenance service.

### 1.02 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Jonesboro, Arkansas.

### 1.03 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

### 1.04 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

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

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner's occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## PART 2 PRODUCTS

### 2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a pre-installation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Matt Silas Architect two days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Matt Silas Architect, the Owner, participants, and those affected by decisions made.

### 3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Matt Silas Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points

during construction.

D. Promptly report to Matt Silas Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Matt Silas Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

**3.05 GENERAL INSTALLATION REQUIREMENTS**

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

**3.06 CUTTING AND PATCHING**

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-conforming work.

C. Execute cutting and patching to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

K. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.

### 3.07 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### 3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

### 3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Matt Silas Architect and owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable personnel and manufacturer's representative

in accordance with manufacturers' instructions.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### 3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01820 - Demonstration and Training.

### 3.11 ADJUSTING

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

### 3.12 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by the Owner prior to final completion before occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Matt Silas Architect.

B. Notify Matt Silas Architect when work is considered ready for Substantial Completion.

C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Matt Silas Architect's review.

D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to owner-occupied areas.

E. Notify Matt Silas Architect when work is considered finally complete.

F. Complete items of work determined by Matt Silas Architect's final inspection.

### 3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Furnish service and maintenance of components indicated in specification sections during the warranty period.

D. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

E. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

F. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

# SECTION 01780

# CLOSEOUT SUBMITTALS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

### 1.02 SUBMITTALS

A. Project Record Documents: Submit documents to Matt Silas Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Matt Silas Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Matt Silas Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with the Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by the Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.

2. Details not on original Contract drawings.

### 3.02 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.03 OPERATION AND MAINTENANCE MANUALS

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

B. Prepare data in the form of an instructional manual.

### 3.04 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with the Owner’s permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

# SECTION 01820

# DEMONSTRATION AND TRAINING

## PART 1 GENERAL

### 1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of the Owner's personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.
   2. Plumbing equipment.
   3. Electrical systems and equipment.

### 1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Training Plan: The Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Matt Silas Architect for transmittal to the Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

### 1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by the Owner.

B. Demonstration may be combined with the Owner's personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

**3.02 TRAINING - GENERAL**

A. Conduct training on-site unless otherwise indicated.

B. Provide training in minimum two hour segments or adequate time allotment relative to complexity of equipment operations.

C. Training schedule will be subject to availability of the Owner's personnel to be trained; re-schedule training sessions as required by the Owner; once schedule has been approved by owner’s failure to conduct sessions according to schedule will be cause for the Owner to charge for personnel "show-up" time.

D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by.
   11. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

# SECTION 02310

# GRADING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Rough grading the site for site structures and building pads.

### 1.02 QUALITY ASSURANCE

A. Perform Work in accordance with State of Arkansas, Highway Department standards.

### 1.03 CIVIL DOCUMENT PRECEDENCE

A. Civil documents shall have precedence in all matters relating to this section.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Topsoil: See Section 02316.

## PART 3 EXECUTION

### 3.01 EXAMINATION

### 3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Protect site features to remain, including but not limited to bench marks and survey control points, from damage by grading equipment and vehicular traffic.

### 3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. See Section 02316 for filling procedures.

F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

### 3.04 SOIL REMOVAL

A. Stockpile topsoil to be re-used on site; remove remainder from site.

### 3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil

contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

D. Place topsoil where required to level finish grade.

E. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches (150 mm).
   2. Areas to be Sodded: 4 inches (100 mm).
   3. Shrub Beds: 18 inches (450 mm).
   4. Flower Beds: 12 inches (300 mm).

F. Place topsoil during dry weather.

G. Remove roots, weeds, rocks, and foreign material while spreading.

H. Near plants spread topsoil manually to prevent damage.

I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

J. Lightly compact placed topsoil.

**3.06 TOLERANCES**

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).

C. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.

D. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

**3.07 REPAIR AND RESTORATION**

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

**3.08 CLEANING**

A. Leave site clean and raked, ready to receive landscaping.

**END OF SECTION**

# SECTION 02315

# EXCAVATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Excavating for footings.

B. Trenching for utilities outside the building to utility main connections.

### 1.02 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Protect bench marks and survey control points from excavating equipment and vehicular traffic.

## PART 3 EXECUTION

### 2.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

### 2.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

### 2.03 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Matt Silas Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut utility trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove excess excavated material from site.

### 2.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

**END OF SECTION**

# SECTION 02316

# FILL AND BACKFILL

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

### 1.02 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: 4 inches (100 mm) below finish grade elevations indicated on drawings, unless otherwise indicated.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Verify that survey bench marks and intended elevations for the Work are as indicated.

## PART 2 PRODUCTS

### 2.01 FILL MATERIALS

A. General Fill - Fill Type sandy gravel (GM), clay gravel(GC), or clayey sand(SC): Local borrow.
   1. Graded.
   2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.
   4. Fill material should conform to recommendations of soils report if provided.

B. Structural Fill - Fill Type non-expansive, red clay sand - 2,500 P.S.F. min. allowable bearing: Local borrow.
   1. Graded.
   2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
   3. Fill material should conform to recommendations of soils report if provided.

C. Granular Fill - Fill Type GW: Coarse aggregate, conforming to State of Arkansas Highway Department standard.

D. Sand: Conforming to State of Arkansas Highway Department standard.

E. Topsoil: See Section 02310.

**2.02 SOURCE QUALITY CONTROL**

A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Identify required lines, levels, contours, and datum locations.

**3.02 PREPARATION**

A. Scarify subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

**3.03 FILLING**

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated on Drawings:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

### 3.04 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Structural Fill at building and paving areas:
   1. Use structural fill.
   2. Fill up to subgrade elevations.
   3. Maximum depth per lift: 6 inches (150 mm), compacted.
   4. Compact to minimum 95 percent of modified proctor maximum dry density.

C. Under Interior Slabs-On-Grade:
   1. Use structural fill.
   2. Compact to 95 percent of modified proctor maximum dry density.

D. At Foundation Walls and Footings:
   1. Use structural fill.
   2. Fill up to subgrade elevation.
   3. Compact each lift to 95 percent of modified proctor maximum dry density.
   4. Do not backfill against unsupported foundation walls.
   5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
   1. Bedding: Use general fill.
   2. Cover with general fill.
   3. Fill up to subgrade elevation.
   4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

### 3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.

### 3.06 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: one per 3,000 sq. feet per lift.

F. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

### 3.07 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

**END OF SECTION**

# SECTION 02317

# TRENCHING FOR SITE UTILITIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

### 1.02 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2007.

C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)); 2009.

E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

F. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where designated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

## PART 2 PRODUCTS

### 2.01 FILL MATERIALS

A. General Fill: Conforming to State of Arkansas Highway Department standard.

B. See Section 02316 for fill type.

C. Structural Fill: Conforming to State of Arkansas Highway Department standard.

## PART 3 EXECUTION

### 3.01 EXAMINATION

### 3.02 TRENCHING

A. Notify Matt Silas Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove excavated material that is unsuitable for re-use from site.

H. Remove excess excavated material from site.

**3.03 PREPARATION FOR UTILITY PLACEMENT**

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

**3.04 BACKFILLING**

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

G. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
   2. At other locations: 95 percent of maximum dry density.

H. Reshape and re-compact fills subjected to vehicular traffic.

**3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS**

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, and Duct Bank:
   1. Bedding: Use general fill.
   2. Cover with general fill.
   3. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

**3.06 TOLERANCES**

A. Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.

**3.07 FIELD QUALITY CONTROL**

A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material

in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

**3.08 CLEANING**

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

**END OF SECTION**

# SECTION 02361

# SOIL TREATMENT FOR TERMITE CONTROL

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Chemical soil treatment.

### 1.02 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements.

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Record moisture content of soil before application.

G. Maintenance Data: Indicate re-treatment schedule.

H. Warranty: Submit warranty and ensure that forms have been completed in the Owner’s name.

### 1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of five years documented experience.

### 1.05 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.
   1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
   2. Inspect annually and report in writing to the Owner. Provide inspection service for five years from Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Manufacturers:
   1. Terminix
   2. Coordinate termite control company with the Owner.
   3. Substitutions: See Section 01600 - Product Requirements.

B. Toxicant Chemical: EPA approved; synthetically color dyed to permit visual identification of treated soil.

### 2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

### 3.02 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

### 3.03 PROTECTION

A. Do not permit soil grading over treated work.

**END OF SECTION**

# SECTION 02741

# BITUMINOUS CONCRETE PAVING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Aggregate base course.

B. Single course bituminous concrete paving.

### 1.02 REFERENCE STANDARDS

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994.

B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.

### 1.03 QUALITY ASSURANCE

A. Perform Work in accordance with State of Arkansas Highways standard.

B. Mixing Plant: Conform to State of Arkansas Highways standard.

C. Obtain materials from same source throughout.

### 1.04 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Aggregate for Base Course: In accordance with State of Arkansas Highways standards.
   1. Class 7 aggregate base course.

B. Prime Coat or Tack Coat: Shall consist of a single application of bituminous material in accordance with State of Arkansas Highway standards.

C. Seal Coat: AI MS-19, sand type.

### 2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Base Course: State of Arkansas Highway standards.

B. Wearing Course: State of Arkansas Highway standards.

### 2.03 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with State of Arkansas Highway standards.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that compacted subgrade and granular base is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

### 3.02 BASE COURSE

A. Place and compact base course.

**3.03 PREPARATION - PRIMER**

A. Apply primer in accordance with State of Arkansas Highway standards.

B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).

C. Use clean sand to blot excess primer.

**3.04 PREPARATION - TACK COAT**

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).

C. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

**3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE**

A. Install Work in accordance with State of Arkansas Highways standards.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to 2 inch (5 mm) compacted thickness.

D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

**3.06 TOLERANCES**

A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.

B. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch (12 mm).

**3.07 FIELD QUALITY CONTROL**

A. See Section 01400 - Quality Requirements, for general requirements for quality control.

**3.08 PROTECTION**

A. Immediately after placement, protect pavement from mechanical injury for 3 days or until surface temperature is less than 140 degrees F (60 degrees C).

**END OF SECTION**

# SECTION 02751

# PORTLAND CEMENT CONCRETE PAVING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete areas.

### 1.02 RELATED REQUIREMENTS

A. Section 02316 - Fill and Backfill: Compacted subbase for paving.

B. Section 02741 - Bituminous Concrete Paving: Asphalt wearing course.

C. Section 03300 - Cast-in-Place Concrete.

D. Section 07900 - Joint Sealers: Sealant for joints.

### 1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

F. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

G. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2010.

I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2011.

J. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.

### 1.04 QUALITY ASSURANCE

A. Perform work in accordance with State of Arkansas Highways standard.

B. Obtain cementitious materials from same source throughout.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

### 1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

## PART 2 PRODUCTS

### 2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 40 (280); deformed billet steel bars; unfinished finish.

### 2.02 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03300.

### 2.03 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Matt Silas Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Concrete Properties:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 psi (28 Mpa).
   2. Water-Cement Ratio: Maximum 40 percent by weight.

### 2.04 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

### 3.02 SUBBASE

A. See Section 02721 for construction of base course for work of this Section.

### 3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

C. Notify Matt Silas Architect minimum 24 hours prior to commencement of concreting operations.

### 3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

### 3.05 REINFORCEMENT

A. Place reinforcement at upper 1/3 of slabs-on-grade.

B. See Drawings.

### 3.06 COLD AND HOT WEATHER CONCRETING

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

### 3.07 PLACING CONCRETE

A. Place concrete in accordance with State of Arkansas Highways standards.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

### 3.08 JOINTS

A. Align curb, gutter, and sidewalk joints.

B. Place 3/8 inch wide expansion joints at 18 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
   1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
   2. Secure to resist movement by wet concrete.

C. Provide sawn joints:
   1. At intervals matching width of walk in sidewalks.
   2. See drawings for layout.

D. Saw cut contraction joints 1/4 inch wide within 8 hours. Cut 1/3 into depth of slab.

### 3.09 FINISHING

A. Area Paving: Light broom, texture perpendicular to pavement direction.

B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch (6 mm) radius.

C. Curbs and Gutters: Light broom, texture parallel to pavement direction.

D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### 3.10 JOINT SEALING

A. See Section 07900 for joint sealer requirements.

### 3.11 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).

B. Maximum Variation From True Position: 1/4 inch (6 mm).

### 3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd (76 cu m) or less of each

class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

**3.13 PROTECTION**

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

**END OF SECTION**

# SECTION 02765

# PAVEMENT MARKINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays, arrows, and handicapped symbols.

### 1.02 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

### 1.03 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Line and Zone Marking Paint: MPI No. 97 Latex Traffic Marking Paint; color(s) as indicated.
   1. Parking Lots: Yellow or White - verify with Owner.
   2. Handicapped Symbols: Blue.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Matt Silas Architect of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

### 3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
   3. Length Tolerance: Plus or minus 3 ( (75 mm).
   4. Width Tolerance: Plus or minus 1/8 inch (3 mm).

G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
   1. Mark the International Handicapped Symbol at indicated parking spaces.
   2. Hand application by pneumatic spray is acceptable.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

**3.04 DRYING, PROTECTION, AND REPLACEMENT**

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to the Owner.

**END OF SECTION**

# SECTION 03100

# CONCRETE FORMS AND ACCESSORIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

### 1.02 RELATED REQUIREMENTS

A. See structural documents for other requirements.

### 1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2008.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

E. PS 1 - Structural Plywood; 2007.

### 1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

### 1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.
   1. Maintain one copy of standards on project site.

### 1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

## PART 2 PRODUCTS

### 2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

### 2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, C Grade, Group 2.

### 2.03 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage (1.5 mm) matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

**2.04 FORMWORK ACCESSORIES**

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 3/4 inch (18 mm) back break dimension, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

C. Form Release Agent: Colorless mineral oil that will not stain concrete.

D. Dovetail Anchor Slot: Galvanized steel, 22 gage (0.8 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

F. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05120.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

**3.02 EARTH FORMS**

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

**3.03 ERECTION - FORMWORK**

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members that are not indicated on drawings.

F. Provide fillet strips on external corners of beams, joists, and columns.

G. Coordinate this section with other sections of work that require attachment of components to formwork.

H. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Matt Silas Architect before proceeding.

**3.04 APPLICATION - FORM RELEASE AGENT**

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or

applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

### 3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04816 if applicable.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

### 3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

### 3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

B. Camber slabs and beams 1/4 inch per 10 feet (2 mm/m).

### 3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

**END OF SECTION**

# SECTION 03300

# CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete foundation walls.

C. Concrete foundations and anchor bolts.

D. Concrete reinforcement.

E. Concrete Accessories including Vapor Barrier.

F. Concrete curing.

### 1.02 RELATED REQUIREMENTS

### 1.03 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Submit design mix prior to installation. Refer to structural documents for requirements.

D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials and aggregates.
   2. Form materials and form-release agents.
   3. Steel reinforcement and reinforcement accessories.
   4. Admixtures.
   5. Curing materials.
   6. Floor and slab treatments.
   7. Bonding agents.
   8. Adhesives.
   9. Vapor retarders.
   10. Epoxy joint filler.
   11. Joint-filler strips.
   12. Repair materials.

G. Minutes of preinstallation conference.

H. Reproduction of contract drawings, in any form, will not be accepted as shop drawings.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

### 1.04 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

E. Installer's Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this project and has a minimum of three years experience.

F. Manufacturer's Qualifications: A company with a minimum of five years experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

G. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1. according to ACI Cp-1 or an equivalent certification program.

H. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

I. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."

J. Preinstallation Conference: Conduct conference at Project site to ensure quality control.
   1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixes.
      c. Ready-mix concrete producer.
      d. Concrete subcontractor.

## PART 2 PRODUCTS

### 2.01 FORMWORK

A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

### 2.02 REINFORCEMENT

A. Reinforcing Steel: See structural documents.

B. Steel Welded Wire Reinforcement: See structural documents.

C. Reinforcement Accessories: See structural documents.

### 2.03 CONCRETE MATERIALS

A. See structural documents for all requirements.

B. Fly Ash: ASTM C618, Class F.

C. Water: Clean and not detrimental to concrete.

### 2.04 CONCRETE MIX DESIGN

A. Refer to structural documents for mix design requirements.

B. Normal Weight Concrete: Reinforced Foundation Footings.
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 psi (20.7 MPa).

C. Normal Weight Concrete: Fill in concrete masonry unit walls; exterior structures, walks and paving; mechanical pads; elevated concrete pads and for all areas not listed otherwise.
   1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi (27.5 Mpa).

D. Normal Weight Concrete: Building Slabs on Grade.
   1. Compressive Strength when tested at 28 days: 4,000 psi

### 2.05 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.
   1. Furnish batch ticket information.
   2. When air temperature is between 85 and 90 degrees F., reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F., reduce mixing and delivery time to 60 minutes.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

### 3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches (150 mm) and seal watertight by taping edges and ends.

### 3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

### 3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Notify Matt Silas Architect not less than 24 hours prior to commencement of placement operations.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

**3.05 FIELD QUALITY CONTROL**

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd (57 cu m) or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

**3.06 DEFECTIVE CONCRETE**

A. Test Results: The testing agency shall report test results in writing to Matt Silas Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Matt Silas Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Matt Silas Architect for each individual area.

**END OF SECTION**

# SECTION 04065

# MORTAR AND MASONRY GROUT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

### 1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures; American Concrete Institute International; 2009.

B. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.

C. ASTM C91 - Standard Specification for Masonry Cement; 2005.

D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2011.

E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2004.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2010.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2007.

H. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

I. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2010.

J. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

K. IMIAWC (HW) - Recommended Practices & Guide Specifications for Hot Weather Masonry Construction; International Masonry Industry All-Weather Council; current edition.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Samples: Submit two samples of mortar, illustrating mortar color and color range.

D. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C 270 and test and evaluation reports per ASTM C 780.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Instructions: Submit packaged dry mortar manufacturer's installation instructions.

### 1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and

foreign matter.

### 1.06 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Masonry Cement: ASTM C91, types as scheduled in this section..

B. Mortar Aggregate: ASTM C144.

C. Water: Clean and potable.

D. Accelerating Admixture: Nonchloride type for use in cold weather.

E. Bonding Agent: Latex type.

F. Sand: Provide white sand if owner choses white mortar.

### 2.02 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.

### 2.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, re-temper only within two hours of mixing.

E. Use mortar within two hours after mixing at temperatures of 90 degrees F (32 degrees C), or two-and-one-half hours at temperatures under 40 degrees F (5 degrees C).

### 2.04 GROUT MIXES

A. Bond Beams and Lintels: 3,000 psi (21 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; provide premixed type in accordance with ASTM C 94/C 94M.
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less.
   2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

### 2.05 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

### 3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches (400 mm) without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

### 3.03 GROUTING

A. Use either high-lift or low-lift grouting techniques, at contactor's option, subject to other limitations of contract documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches (300 mm).
   2. Limit height of masonry to 16 inches (400 mm) above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:
   1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
   2. Brick: Limit pours to maximum 12 feet (3.66 m) in height and 25 feet (7.6 m) horizontally.
   3. Hollow Masonry: Limit lifts to maximum 4 feet (1.2 m) and pours to maximum height of 24 feet (7.3 m).
   4. Place grout for spanning elements in single, continuous pour.

**END OF SECTION**

# SECTION 04210

# BRICK MASONRY UNITS

## PART 1 - GENERAL

### 1.01 SECTION INCCLUDES

A. Brick units.

B. Reinforcement, anchors, and accessories.

### 1.02 SUBMITTALS

A. Submit samples of brick to reflect the full range of color, shades and surface texture of brick specified.

### 1.03 MOCKUP

A. As soon as the brick and stone samples have been approved, deliver enough brick to the job site to construct a 6’-0” x 4’-0” sample wall panel, incorporating both metal stud backup and CMU backup.

B. Construct the mockup panel using the brick, mortar, reinforcing, weep holes, tooling, and cleaning as specified.

C. The approved sample panel shall be standard of workmanship.

D. As construction proceeds, the first full panel of brickwork between expansion joints shall become the standard of workmanship for issues, such as head joint alignment, that are not apparent on the smaller mockup panel.

E. Mockup panel shall not be removed until masonry work as required by this section has been completed.

### 1.04 ENVIRONMENTAL CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

### 1.05 DELIVERY, STORAGE AND HANDLING OF MATERIALS

Deliver, store, and handle materials to prevent inclusion of foreign materials and damage by water or weather. Store packaged materials in their original packages. Damaged or deteriorated materials shall be removed from the premises.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE BRICK MANUFACTURERS

A. Acme Brick Company.

B. Caubble Stone and Brick.

C. Substitutions: Under provisions of Section 01600.

### 2.02 BRICK UNITS

A. Standard Face Brick: Shall be Brick shall be HBS in general and FBS for sills and where large face

is exposed and shall be as follows:

a. Modular in size, 2 1/4 x 3 5/8 x 7 5/8 inches, and conform to the requirements of ASTM C 216 or C 652, Grade SW.

B. Special shape face bricks shall be as detailed and at locations as indicated on the drawings.

C. Furnish special uncored face brick in locations where cores would be exposed in finish work.

**2.03 ANCHORS AND TIES**

A. Acceptable Manufacturers:

1. Products of Hohmann and Barnard and Heckman Bldg. Products, conforming to specification requirements are acceptable.

2. Substitutions: Under provisions of the General Provisions.

B. Anchors:

1. Slotted anchors of type DW10 shall be used with steel stud or wood stud backup walls, UNO.

2. Dur-O-Eye or equal anchors welded to joint reinforcing shall be used with masonry backup walls. Missing or damage anchors shall be replaced as necessary with DW19 anchors fastened to wall with corrosion resistant Tapcon screws.

3. Anchors and ties for stone veneer shall be as recommended by the manufacturer.

4. Zinc coating shall comply with ASTM A153-B2.

**2.04 ACCESSORIES**

A. Weep Holes: Open head joints every third brick at lintels and other locations. Provide Mortar Net weeps at each weep hole.

B. Compressible Filler: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35% of width and thickness indicated.

C. Mortar Net: Provide continuous Mortar Net along base of air space to catch mortar drippings. High-density polyethylene, 90% open mesh, dovetail shape.

D. As an alternate to Mortar Net, every third brick may be left out at base of air space and cavity cleaned and inspected to be free of mortar droppings.

**PART 3 - EXECUTION**

**3.01 LAYING AND SETTING BRICK**

A. Pre-wet all brick having initial rate of absorption greater than 30 before laying.

B. Heat water and sand in cold weather. Do not lay brick in temperature below freezing unless such heating of materials and protection of work is properly provided for.

C. The exterior surfaces of concrete and concrete masonry backup walls shall be damp-proofed before face brick are laid.

D. All brickwork shall be laid true to dimensions, plumb, square, and in bond. All courses shall be level with joints of uniform width and height.

E. Vertical joints in facing bond work shall be spaced so as to line up plumb and true, and all joints shall be as uniform as the type of brick will allow.

F. Lay facing brick in full mortar bed with shoved head joints. Completely fill joints with mortar. Do not deep furrow bed joints.

G. Allow space for caulking of joints at frames.

H. Bond for facing brick shall be running bond or as shown on drawings. Match existing bond patterns unless noted otherwise.

I. Anchor facing brick to metal studs or masonry backup at 16 inches o.c. vertically and 16 inches o.c. horizontally with adjustable anchors and ties.

J. Joint thickness shall be such as to provide coursing pattern to match existing brickwork. When the joints have become thumbprint hard, all exposed joints shall be tooled with a sled-jointing tool. The jointer shall be larger than the width of the joints so that a complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Joints shall be pointed as the tool proceeds.

K. Form weep holes in head joints at face brick over shelf angles and lintels and where shown on the drawings. Rake out bed joint mortar to clean flashing surface. Weep holes shall be filled with preformed mesh type vent at bottom of head joints not more than 24 inches o.c.

L. Keep air space clean of mortar at all times. Where brick extends below grade, fill brick cavity solid to level of flashing and slope mortar slightly to outside under flashing.

M. When flashing is to be laid on or against masonry, the surface of the masonry shall be smooth and free from projections which might puncture the flashing material.

N. Where fresh masonry joins masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned and lightly wetted so as to obtain the best possible bond with the new work. All loose brick and mortar shall be removed.

O. Expansion Joints:

1. Vertical: Locate where indicated on drawings. Lay units to form a vertical joint free of mortar and of same width as normal head joint UNO.

2. Horizontal: Locate under shelf angles and other dissimilar materials abutted by brick. Maintain a clear space at least 1/4-inch thick free of mortar. Inspect with trowel before installing backer rod and sealant.

3. Sealant: Shall be in accordance with Section 07900.

**3.02 FLASHINGS**

Build in, as the work progresses all flashings which enter the masonry using the material and following the instructions of the appropriate section of the specifications.

Extend all flexible flashing 1” past face of wall and trim after tooling joints.

Where metal flashing or drip edge is shown, align drip with face of brick. Edge of flashing or drip edge shall be a simple hem rolled edge and not turned down.

**3.03 OPENINGS AND HOLES**

A. Provide all openings and holes in masonry work. Provide all chases and recesses in masonry work of

all types as indicated on the drawings and as required for pipes, ducts, and other work of Mechanical and Electrical contractors. Such work shall be accurately located by the contractor requiring the work, but masonry work shall not be constructed without giving other contractors due notices and opportunity to lay out or install such items as may be required for their work.

B. Where required for installation of work of other contractors, leave openings as indicated on the drawing or as required to receive a later installation.

C. After work of other contractors is in place, openings shall be neatly filled with masonry of the same type as in the adjoining surfaces.

**3.04 SETTING AND BUILDING-IN**

A. Build-in materials occurring in any type of masonry construction that are furnished by other contractors. All built-in work shall be accurately placed, secured, held in position, and located by the contractor requiring the work.

B. Set and built -in items of miscellaneous iron such as loose lintels and anchors required to complete all parts not connected to building framing.

C. Set all anchor bolts required for the attachment of work to masonry.

D. Build-in recesses, flashings, receivers, slots, anchors, sleeves and other work shown on Drawings.

**3.05 PROTECTION**

A. At the end of each day's work, cover the tops of walls with canvas or other suitable material weighted down to keep water out of wall.

**3.06 CLEANING BRICKWORK**

A. After pointing is done and wall is dry, clean face brick surface with dry brush.

B. After 3 days clean with water and mild detergent or cleaners recommended by brick manufacturer. Do not use muriatic acid.

a. Wet brick surfaces thoroughly before applying cleaning solution.

b. Apply cleaning solution with bucket and brush or LOW PRESSURE spray.

c. Remove all stains and mortar streaks using stiff fiber bristle brush.

d. Rinse THOROUGHLY with water.

e. Protect windows, landscaping, and surrounding masonry surfaces from cleaning solution and rinse water.

**END OF SECTION**

# SECTION 04720

# PRECAST MEDALLION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. This section covers all material, labor, accessories and appliances necessary for the complete installation of SculptStone™ cast stone ornaments as indicated on the drawings and specified herein.

### 1.02 MANUFACTURER

A. All SculptStone™ cast stone ornaments used in this work shall be manufactured by Pineapple Grove Designs, Palm Beach County, FL 33425, (800) 771-4595, and shall meet the specifications as indicated in the manufacturer's Tech Data sheets.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit in accordance with Architect's Section. Indicate materials, construction, dimensions, locations, connections and installation details.

C. Product Data: Submit manufacturer's descriptive literature and installation instructions.

D. Samples: Submit samples of SculptStone™ material to architect for approval of color, shade, finish and material.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store units by means that will prevent mechanical damage and contamination by other materials.

B. The pieces shall be stored on the job site in the same crating and packaging used for shipment. The packages and/or crates shall be stored on a level area clear of the ground and protected from the weather and other trades. If pieces are to be stored after uncrating, they should be placed carefully on edge and secured on non-staining supports. Pieces shall be stacked a maximum of one row high and protected from the weather and damage.

## PART 2 PRODUCTS

### 2.01 COMPOSITION

A. All SculptStone™ cast stone ornaments shall be a matrix of proprietary ingredients including cement, crushed and graded stone, virgin polypropylene fiber, iron oxide pigment, and admixtures necessary to achieve required physical properties.

### 2.02 MEDALLION

A. Design Name: Custom design as indicated on drawings.

B. Color: Selected from Sculpstone Color Chart.

C. Size: 48" diameter.

### 2.02 INGREDIENTS INCLUDE

A. Cement: Type 1 White meeting ASTM C150.

B. Aggregate: Graded and washed natural sands and crushed grated stone Meeting ASTM C33, except that gradation may vary to achieve desired finish and texture; ± Post Consumer Glass and Aggregate.

C. Fiber: Virgin homopolymer polypropylene non-fibrillated fibers.

D. Coloring: Inorganic synthetic iron oxide pigments meeting ASTM C979 dispersed integrally throughout the mix.

E. Admixtures: Proprietary list of ingredients necessary to achieve required air entrainment, low permeability, accelerated cure, increased flexural and compressive strength and freeze-thaw resistance.

**2.03 RELATED MATERIALS**

A. Mechanical Fasteners (Lugs): ¼" x 20 female stainless steel threaded imbed anchors shall be cast in the rear of each medallion by Pineapple Grove Designs. Pineapple Grove Designs shall provide ¼" x 20 stainless steel studs to be threaded into anchors at job site. Studs shall project from rear of cast stone ornament a minimum of 1" into hole drilled in the structural substrate of the mounting wall.

B. Adhesive: Solvent based construction adhesive or cement thinset mortar manufactured by others specifically for vertical tile or masonry bonding and incorporating bonding agent in cement mix.

C. Joint Finishing: Caulked joints and perimeter shall be caulking sealant type and color recommended by caulking manufacturer and approved by architect. Grouting or pointing mortar shall be composed of one part non-staining cement (ASTM C91), one part hydrate lime (ASTM C207 Type S) and four parts clean, washed sand (ASTM C144). Coloring pigments may be added as required. The architect shall approve color of mortar before proceeding with grouting or pointing.

**2.04 FABRICATION**

A. SculptStone™ cast stone ornaments shall be manufactured in accordance with manufacturer's strict guidelines for ingredient ratios, material mixing and consolidation, mold surface integrity, color and finish uniformity and curing methods for maximum strength achievement.

**2.05 SHIPPING**

A. All SculptStone™ cast stone ornaments shall be carefully loaded and packed for transportation exercising customary and reasonable precaution against damage while in transit. All product shall be released to freight carrier in a sound, unblemished and unbroken condition.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Inspect adjacent construction for conditions that would prevent proper installation of SculptStone™ cast stone ornaments. Inspect substrate for soundness and surface adhesion quality.

B. Inspect product in crates for any damage from shipping. Notify manufacturer of any hidden damage. Inspect product for any variations in color, finish, tolerance or design as shown on manufacturer's shop drawings or architect's plans. Report any discrepancy to manufacturer.

**3.02 INSTALLATION**

A. Install SculptStone™ cast stone ornaments true, plumb and level in accordance with manufacturer's installation instructions and Tech Data sheet. All pieces shall be set by experienced and qualified stone masons or tile setters in accordance with the shop drawings.

B. Installer shall use necessary personal safety equipment to protect against hazards associated with stone and mortar fabrication, assembly and installation.

C. All SculptStone™ items shall be installed according to specifications included here in.

Additional specifications shall apply if requested. Ultimate connection design is the responsibility of Building Design Engineer, Architect, or otherwise responsible person charged with the design connection.

D. All substrate to receive SculptStone™ pieces shall be prepared as indicated in manufacturer's Tech Data sheet. Substrate shall be clean of any oil, paint, dust or debris. Surface shall be smooth, level sound and capable of a successful and permanent adhesion to the setting material.

E. When setting with mortar all pieces not thoroughly wet shall be drenched with clear potable water and excess water removed just prior to setting.

F. Unless otherwise noted, every piece shall be set in a full bed of mortar with all vertical joints flushed full. All anchors shall be firmly in place and all anchor holes and similar holes filled completely with mortar.

G. After setting, if required, each piece shall be braced with a diagonal support to the face and rest on a previously installed temporary horizontal ledger to be removed after full cure of setting material. The face of each piece shall then be sponged off to remove any splashed mortar or mortar smears.

H. All pieces shall be protected from splashing mortar or damage by other trades. Any foreign matter splashed or rubbed on the pieces shall be removed immediately.

I. A foam or wood "plug" ½" larger than the intended piece shall be temporarily installed on the substrate in applications where SculptStone™ cast stone ornaments are not immediately available or construction conditions prohibit a timely installation. This plug shall be removed and typical installation shall proceed according to this section.

J. ½" minimum tolerance required in surrounding opening dimensions (i.e. 16" sq. medallion requires a 16 ½" x 16 ½" opening).

**3.03 PATCHING**

A. The repair of chipped or damaged SculptStone™ shall be done only by mechanics skilled in his work with materials furnished by the manufacturer and according to his direction.

B. SculptStone™ shall show no obvious repairs or imperfections other than the minimal color variations when viewed with the unaided eye under good typical lighting.

**3.04 CLEANING**

A. The face of all SculptStone™ cast stone ornaments shall be cleaned where necessary by scrubbing with a bristle fiber brush, using soap powder and water and shall be rinsed thoroughly with clean running water. No acid or prepared cleaners shall be used without the approval of the SculptStone™ manufacturer.

**3.05 SEALING**

A. After cleaning and drying and full cure of any cementatious grouts (approximately 30 days), SculptStone™ cast stone ornaments may be sealed with a silicone stearate solution. Follow sealer manufacturer's instructions and apply to inconspicuous test area to determine job specific results.

**END OF SECTION**

# SECTION 04810

# UNIT MASONRY ASSEMBLIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete Block.

B. Reinforcement and Anchorage.

C. Accessories.

### 1.02 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures; American Concrete Institute International; 2009.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2008.

C. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2009.

F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2011.

G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2006.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2010.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

J. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2001.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Samples: Submit four samples of decorative block and facing brick units to illustrate color, texture, and extremes of color range.

### 1.04 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

### 1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## PART 2 PRODUCTS

### 2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depths as indicated on the drawings for specific locations.
   2. Load-Bearing Units: ASTM C90,.
      a. Hollow block, as indicated.
      b. Exposed faces: Manufacturer's color and texture where indicated.
   3. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Exposed faces: Manufacturer's color and texture where indicated.

### 2.02 MORTAR AND GROUT MATERIALS

A. Mortar and grout: As specified in Section 04065.

### 2.03 REINFORCEMENT AND ANCHORAGE

A. See drawings for requirements.

### 2.05 FLASHINGS

A. Rubberized Asphalt Flashing: Self-adhering polymer-modified asphalt sheet; 0.030 inch (0.75 mm) total thickness; with cross-linked polyethylene top and bottom surfaces.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc..
      b. Substitutions: See Section 01600 - Product Requirements.

### 2.06 ACCESSORIES

A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; 3/8 inch wide x by maximum lengths available.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### 3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### 3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
3. Mortar Joints: Concave.

### 3.04 PLACING AND BONDING

A. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

H. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### 3.05 GROUTED COMPONENTS

A. Lap splices minimum 48 bar diameters.

B. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

### 3.06 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joint in accordance with Section 07900 for sealant performance.

### 3.07 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

### 3.08 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

# SECTION 04820

# CONCRETE MASONRY VENEER UNITS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Concrete Masonry Veneer Units.

### 1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Samples: Submit 4 samples to illustrate color, texture, and extremes of color range.

### 1.03 QUALITY ASSURANCE

A. Certifications: Units are solid non-load bearing concrete masonry units. Units are manufactured by means of moisture controlled curing for 24 hours minimum. Units shall conform to ASTM C744 with respect to abrasion, crazing resistance, and color change.

B. Field Constructed Mock-Ups: Construct a sample panel no less than 4’ x 6’ containing each color and size units to be used in the project illustrating color, clear sealer finish, texture, and mortar joints to establish a standard of quality for completed work. Retain mock-up during construction as a quality standard. Completely remove when work is accepted.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Units shall be delivered on covered wood pallets in such a way as to protect faces. Palletized units shall not be stacked on top of each other.

B. Store in protected area and covered to ensure units remain dry and clean at all times. Do not allow units to sit in standing water or be exposed to rain.

C. Handle masonry units in manner to avoid chipping, breaking, contact with contaminating materials, and marring of faces.

### 1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

## PART 2 PRODUCTS

### 2.01 CONCRETE MASONRY UNITS

A. Chiseled Face Concrete Veneer Units: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 12 x 24 inches and nominal depth of 4 inches.

### 2.02 MANUFACTURER

A. Nettleton Concrete, Inc. (800) 382-2462.

Jonesboro, Arkansas

### 2.02 MORTAR AND GROUT MATERIALS

A. Mortar and grout: As specified in Section 04065.

B. Allow for colored mortar.

### 2.03 WATER REPELLENCY

A. Units to be manufactured with RainBloc integral water repllant, or approved equal, to assist in controlling efflorescence. Use of RainBloc mortar admixture, or approved equal, according to manufacturer's recommendations is required for a water repellant.

**2.04 ANCHORS AND TIES**

A. Acceptable Manufacturers:

1. Products of Hohmann and Barnard and Heckman Bldg. Products, conforming to specification requirements are acceptable.

2. Substitutions: Under provisions of the General Provisions.

B. Anchors:

1. Slotted anchors of type DW10 shall be used with steel stud or wood stud backup walls, UNO.

2. Dur-O-Eye or equal anchors welded to joint reinforcing shall be used with masonry backup walls. Missing or damage anchors shall be replaced as necessary with DW19 anchors fastened to wall with corrosion resistant Tapcon screws.

3. Anchors and ties for stone veneer shall be as recommended by the manufacturer.

4. Zinc coating shall comply with ASTM A153-B2.

**2.05 FLASHINGS**

A. Rubberized Asphalt Flashing: Self-adhering polymer-modified asphalt sheet; 0.030 inch (0.75 mm) total thickness; with cross-linked polyethylene top and bottom surfaces.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc..
      b. Substitutions: See Section 01600 - Product Requirements.

**2.06 ACCESSORIES**

A. Weep Holes: Open head joints 24" horizontal at base of wall above thru-wall flashing and at lintel conditions. Provide Mortar Net weeps at each weep hole.

B. Compressible Filler: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41E1, capable of compression up to 35% of width and thickness indicated.

C. Mortar Net: Provide continuous Mortar Net along base of air space to catch mortar drippings. High-density polyethylene, 90% open mesh, dovetail shape.

D. Masonry Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials as recommended by manufacturer. Do not apply cleaner with a pressure sprayer above 50 psi..

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### 3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation.

### 3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Mortar Joints: Concave.

### 3.04 PLACING AND BONDING

A. Lay units from more than on pallet at a time during installation. Complete masonry construction using procedures and workmanship consistent with quality masonry practices.

B. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### 3.05 CUTTING

A. Field cut units with motor-driven masonry saws using an abrasive or diamond blade to provide straight true edges and avoid damage to face.

B. Field split and chisel corners with suitable tools to insure uniform texture and consistency of face.

C. Do not install chipped or broken units

### 3.06 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joint in accordance with Section 07900 for sealant performance.

### 3.07 CLEANING

A. Exercise care that wet mortar is not splashed onto burnished face during installation.

B. Excess or splashed mortar shall be cleaned from face with dry burlap wipe or masonry brush.

C. Remove after mortar becomes hard enough not to smear but prior to mortar setting.

D. Final Cleandown: Clean completed wall surfaces using masonry cleaners such as 222 Cast Stone & Burnished Masonry Clenzer manufactured by Diedrich Technologies, Inc. Dilute cleaning solution as recommended by manufacturer. Strictly follow manufacturer's cleaning instructions. Do not use acid or abrasives on finished surfaces. Do not powerwash. High pressure powerwashing may interfere with performance of the integral water repellent causing efflorescence.

### 3.08 FIELD APPLIED SEALER

A. For finished walls that have been cleaned, washed, and dried, apply a jobsite application of Bright Kure & Seal manufactured by TK Products or equivalent as directed by manufacturer's recommendations.

### 3.09 PROTECTION

A. During erection, cover top of walls with waterproof sheeting at end of each day. Cover partially completed walls when work is not in progress. Extend cover 24 inches minimum down both sides and hold securely in place. Protect face of walls, sills, and other projections from roof run-off, splashed water, mud, grout, and mortar. Spread sand or straw at base of walls to minimize dirt and clay splashing onto burnished faces. Without damaging completed work, it is recommended to provide protective boards at exposed external corners which may be damaged by construction activities.

B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

# SECTION 05120

# STRUCTURAL STEEL

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Structural steel framing members, support members, sag rods, and struts.

B. Base plates, shear stud connectors and .

C. Grouting under base plates.

### 1.02 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2005.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.

C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2008.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2010.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2007.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

I. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2004 (Reapproved 2009).

J. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2010.

K. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009a.

L. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.

M. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength; 2010a.

N. ASTM A490M - Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric); 2010.

O. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.

P. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

Q. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2005 (Reapproved 2009).

R. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2005 (Reapproved 2009).

S. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.

T. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

U. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2006a.

V. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2011.

W. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability; 2010.

X. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2011.

Y. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments; 2008.

Z. ASTM F436 - Standard Specification for Hardened Steel Washers; 2010.

AA. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2009.

AB. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

AC. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

AD. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

AE. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

### 1.03 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections not detailed.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
5. Indicate type, size and length of bolts distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
6. Reproduction of contract drawings, in any form, will not be accepted as shop drawings.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
1. Structural steel including chemical and physical properties.
2. Bolts, nuts and washers including mechanical properties and chemical analysis.
3. Sheer stud connectors.
4. Shop primers.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

### 1.04 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

B. Comply with Section 10 of AISC "Code of Standard Practice for Steel Buildings and Bridges"

for architecturally exposed structural steel.
1. AISC "Seismic Provisions for Structural Steel Buildings" and supplements.

C. Fabricator: Company specializing in performing the work of this section with minimum three years of documented experience.

D. RCSC's "Specification for Structural Joints using ASTM A 325 or A490 Bolts".

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel (AC172).

F. Erector: Company specializing in performing the work of this section with minimum three years of documented experience.

G. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Arkansas.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

**1.06 COORDINATION**

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. See structural documents for requirements and standards for materials and components used.

B. Steel Angles and Plates: ASTM A36/A36M.

C. Steel W Shapes and Tees: ASTM A992/A992M.

D. Rolled Steel Structural Shapes: ASTM A992/A992M.

E. Steel Shapes, Plates, and Bars: ASTM A 242/A 242M high-strength, corrosion-resistant structural steel.

F. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

G. Cold-Formed Structural Tubing: ASTM A500, Grade B.

H. Hot-Formed Structural Tubing: ASTM A501, seamless or welded.

I. Steel Bars: ASTM A108 Grade as indicated on drawings.

J. Steel Plate: ASTM A514/A514M.

K. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

L. Pipe: ASTM A53/A53M, Grade B, Finish black.

M. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.

N. Sag Rods: ASTM A 36/A 36M.

O. Anchor Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A galvanized to ASTM A 153/A 153M, Class C.

P. Steel-to-Steel Connection, High-Strength Structural Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, medium carbon, plain.

Q. High-Strength Structural Bolts: ASTM A490 (ASTM A490M), with matching ASTM A563 (ASTM A563M) nuts and ASTM F436 washers; Type 1 alloy steel.

R. High-Strength Anchor Bolts: ASTM A 325, Type 1 medium carbon, plain.

S. Load Indicator Washers: Provide washers complying with ASTM F959 at all connections requiring high-strength bolts.

T. Welding Materials: AWS D1.1; type required for materials being welded.

U. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107 and capable of developing a minimum compressive strength of 7000 psi (____ MPa) at 28 days unless noted otherwise on drawings.

V. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
   1. Lead free alkyd primer; Tnemec 10-99 Series, Southern Coatings Environ-Guard 1-2900, or approved equal, meeting performance requirements of TT-P-86, Type I and passing ASTM B 117 after 500 hours with no blistering, cracking, softening, delamination, or rust creepage at scribe and rusting at edges.

W. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

**2.02 FABRICATION**

A. Shop fabricate to greatest extent possible.

B. Space sheer stud connectors as shown on drawings.

C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

D. Fabricate connections for bolt, nut, and washer connectors.

E. Develop required camber for members.

**2.03 FINISH**

A. Prepare structural component surfaces in accordance with SSPC SP-2 and SP-3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, high strength bolted, or field installed headed studs.
   1. Dry film thickness of not less than 2 mils.

**2.04 SOURCE QUALITY CONTROL**

A. Welded Connections: Visually inspect all shop-welded connections and test welds using the following:
   1. Ultrasonic testing performed in accordance with ASTM E164.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

**3.02 ERECTION**

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

E. Do not field cut or alter structural members without approval of Matt Silas Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for non-shrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

**3.03 TOLERANCES**

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

**3.04 FIELD QUALITY CONTROL**

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
   1. Ultrasonic testing performed in accordance with ASTM E164.

**END OF SECTION**

# SECTION 05400

# COLD-FORMED METAL FRAMING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Load-bearing wall framing.

B. Exterior non-load-bearing wall framing.

C. Interior non-load-bearing wall framing.

D. Floor joist framing.

E. Ceiling joist framing.

F. Soffit framing.

### 1.02 REFERENCE STANDARDS

A. AISI SG-973 - Cold-Formed Steel Design Manual; American Iron and Steel Institute; 1996.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2000.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2011.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2010.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

H. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.

I. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Submit shop drawings and calculations sealed and signed by a professional engineer licensed in the state of Arkansas for review prior to fabrication.

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining

work.

E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and manufacturer's standard details.

### 1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

### 1.05 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on the drawings.

B. Coordinate work of this section with the placement of components within the stud framing system.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
1. ClarkDietrich Building Systems LLC: www.clarkdietrich.com.
2. Marino\Ware: www.marinoware.com.
3. Nucon Steel www.nuconsteel.com.
4. Substitutions: See Section 01600 - Product Requirements.

### 2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Metal Framing Connectors and Accessories:
1. Same manufacturer as framing.

C. Maximum Spacing and Layout Requirements: Exterior wall studs shall be spaced at 16 inches on center typical spacing and at 12 inches on center within 6 feet of all building corners.

### 2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
1. Gage and depth: As indicated on the drawings.
2. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.
3. Provide components fabricated from ASTM A1008/A1008M, Designation SS steel.

### 2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### 2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Power actuated.

C. Welding: In conformance with AWS D1.1.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

### 3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs and where specified in documents.

E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

H. Install intermediate studs above and below openings to align with wall stud spacing.

I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

J. Attach cross studs to studs for attachment of fixtures anchored to walls.

K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged galvanized surfaces with primer.

### 3.03 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch (6 mm).

**END OF SECTION**

# SECTION 06100

# ROUGH CARPENTRY

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Non-structural dimension lumber framing.

C. Rough opening framing for doors, windows, and roof openings.

D. Sheathing.

E. Subflooring.

F. Preservative treated wood materials.

G. Miscellaneous framing and sheathing.

H. Communications and electrical room mounting boards.

I. Concealed wood blocking, nailers, and supports.

J. Miscellaneous wood nailers, furring, and grounds.

### 1.02 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2001.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

D. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.

F. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

G. SPIB (GR) - Grading Rules; Southern Pine Inspection Bureau, Inc.; 2002.

### 1.03 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

**2.02 DIMENSION LUMBER**

A. Grading Agency: Southern Pine Inspection Bureau, Inc. (SPIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry or MC15.

D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm) ):
1. Species: Spruce-Pine-Fir (South).
2. Grade: No. 2.

E. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm) ):
1. Species: Spruce-Pine-Fir (South).
2. Grade: No. 1 & Btr.

F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

G. Miscellaneous Blocking, Furring, and Nailers:
1. Lumber: S4S, No. 2 or Standard Grade.

**2.03 CONSTRUCTION PANELS (when applicable)**

A. Subfloor/Underlayment Combination: APA PRP-108, Rated Sturd-I-Floor.
1. Exposure Class: Exterior.
2. Span Rating: 24 inches (610 mm).
3. Thickness: 3/4 inches (19 mm), nominal.

B. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exposure 1, and as follows:
1. Span Rating: 24/16.
2. Thickness: 1/2 inch (13 mm), nominal.

C. Roof Panels: APA PRP-108, Structural I Rated Sheathing, Exposure 1, and as follows:
1. Span Rating: 40/20.
2. Thickness: 5/8 inch, nominal.

D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

E. See structural documents for other requirements.

**2.04 ACCESSORIES**

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

C. Subfloor Glue: APA AFG-01, Waterproof, water base, air cure type, cartridge dispensed.

**2.05 FACTORY WOOD TREATMENT**

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
      b. Substitutions: See Section 01600 - Product Requirements.

C. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m) retention.
   1. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL**

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

**3.02 FRAMING INSTALLATION**

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

D. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

E. Install structural members full length without splices unless otherwise specifically detailed.

F. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA Wood Frame Construction Manual.

G. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.

H. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

I. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

**3.03 BLOCKING, NAILERS, AND SUPPORTS**

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

### 3.04 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Place full width continuous sill flashings under framed walls on cementitious foundations. Lap flashing joints 4 inches (100 mm) and seal.

B. Coordinate installation of wood decking, wood chord metal joists, glue laminated structural units, prefabricated wood trusses, and plywood web joists.

### 3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and Screw to framing; staples are not permitted.

B. Subflooring: Glue and Screw to framing; staples are not permitted.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
   1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches (2440 mm), measured horizontally.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

### 3.06 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet (1 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

### 3.07 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

# SECTION 06114

# WOOD BLOCKING AND CURBING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Blocking in wall openings.

B. Preservative treatment of wood.

C. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.

### 1.02 REFERENCES

A. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

B. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood-Preservers' Association; 2002.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2005.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

### 1.03 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Lumber of other species or grades, or graded by other agencies, is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A. Lumber fabricated from old growth timber is not permitted.

### 2.02 DIMENSION LUMBER

A. Moisture Content: S-dry or MC19.

B. Miscellaneous Blocking, Furring, and Nailers:
   1. Lumber: S4S, No. 2 or Standard Grade.

### 2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and treated wood locations, unfinished steel elsewhere.

### 2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Pressure Treatment of Lumber in Contact with Soil: AWPA Treatment C2 using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m) retention.

## PART 3 EXECUTION

### 3.01 FRAMING INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members with crown side up.

C. Construct curb members of single pieces.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

E. Coordinate curb installation with installation of decking and support of deck openings.

F. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.

### 3.02 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

**END OF SECTION**

# SECTION 06200

# FINISH CARPENTRY

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

### 1.02 REFERENCE STANDARDS

A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004.

C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

D. PS 1 - Structural Plywood; 2007.

### 1.03 QUALITY ASSURANCE

A. Perform work in accordance with AWI Architectural Woodwork Quality Standards Illustrated, Premium grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

## PART 2 PRODUCTS

### 2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Interior Woodwork Items:
   1. Paint Grade Moldings, Bases, Casings, and Miscellaneous Trim: see drawings; prepare for paint finish.
   2. Stain Grade Moldings, Bases, Casings, and Miscellaneous Trim: see drawings; prepare for stain finish.
   3. Door, Glazed Light, and Pocket Door Frames: see drawings; prepare for stain finish.

### 2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

### 2.03 LUMBER MATERIALS

A. Softwood Lumber: to be determined species, to be determined sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

B. Hardwood Lumber: to be determined species, to be determined sawn, maximum moisture

content of 6 percent; with vertical grain, of quality suitable for transparent finish.

**2.04 SHEET MATERIALS**

A. Softwood Plywood Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B; glue type as recommended for application.

B. Softwood Plywood Exposed to View: Face species to be determined,, veneer core; PS 1 Grade A-B; glue type as recommended for application.

C. Hardwood Plywood: Face species to be determined, rotary cut, balance matched, veneer core; HPVA HP-1, Grade AA, Type ; glue type as recommended for application.

**2.05 FASTENINGS**

A. Fasteners: Of size and type to suit application; galvanized finish in concealed locations and pre-finish in exposed locations.

B. Concealed Joint Fasteners: Threaded steel.

**2.06 ACCESSORIES**

A. Lumber for Shimming, Blocking, and Furring: Softwood lumber of Southern Pine species.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

**3.02 INSTALLATION**

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

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

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim to conceal larger gaps.

**3.03 TOLERANCES**

A. Maximum Variation from True Position: 1/16 inch (1.5 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.7 mm).

**END OF SECTION**

# SECTION 06415

# COUNTERTOPS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

B. Wall-hung counters and vanity tops.

### 1.02 REFERENCE STANDARDS

A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.

B. ANSI A208.1 - American National Standard for Particleboard; 1999.

C. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2002.

D. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2006.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

F. ISSFA-2 - Classification and Standards for Solid Surfacing Material; International Solid Surface Fabricators Association; 2001 (2002)

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

C. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

### 1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

### 1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 PRODUCTS

### 2.01 COUNTERTOP ASSEMBLIES

A. Plastic Laminate Countertops: See Section 06620 – Decorative plastic laminate.

### 2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### 3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach countertops as recommended by manufacturer.

### 3.04 CLEANING AND PROTECTION

A. Clean countertops surfaces thoroughly.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

# SECTION 06620

# DECORATIVE PLASTIC LAMINATE

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Standard Decorative Laminates.

B. Decorative Edges and Edgeband.

### 1.02 REFERENCE STANDARDS

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 162: Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

C. ASTM E 662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Fully dimensioned shop drawings showing layouts and components, including edge conditions, joinery, terminating conditions, substrate construction, and cutouts and holes. Include elevations, section details, and large scale details. Indicate color, pattern, and finish selections.

C. Samples: Selection and verification samples for each color, pattern, and finish required.

D. Maintenance Data: Manufacturer’s published maintenance manual with closeout submittals.

### 1.04 REGULATORY REQUIREMENTS

A. Adhesives, Sealants, and Sealant Primers:
   1. SCAQMD (South Coast Air Quality Management District) Rule 1168 for VOC content.
   2. Ozone Transport Commission (OTC) model Rule for Adhesives and Sealants.

### 1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: Manufacturer producing products in an ISO 9001, ISO 14001, and OHSAS 18001 certified facility.
   2. Fabricator Qualifications: Minimum of three years documented experience in fabricating decorative plastic laminates similar in scope and complexity of this Project.
   3. Installer Qualifications: Minimum of three years documented installation experience for projects similar in scope and complexity to this Project.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Store plastic laminate materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store sheet materials flat on pallets or similar rack-type storage to preclude damage B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

### 1.07 PROJECT CONDITIONS

A. Environmental Requirements: Ensure appropriate acclimatization between plastic laminate and substrate prior to fabrication. Condition plastic laminate and substrate surfaces in the

same environment for 48 hours prior to fabrication. Condition at approximately 75 deg F and 45 percent to 55 percent relative humidity.

1. Adhesive: For best results, apply adhesives at temperatures at or above 65 deg F (18 deg F).

B. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

## PART 2 PRODUCTS

### 2.01 MANUFACTURER

A. Wilsonart International, Inc: www.wilsonart.com.

B. Formica Corporation: www.formica.com.

C. Substitutions: See Section 01600 - Product Requirements.

### 2.02 LAMINATE PROPERTIES

A. Laminate Composition: Decorative surface papers impregnated with melamine resins and pressed over kraft paper core sheets impregnated with phenolic resin. Sheets then bonded together under pressures greater than 1,000 lbs. per sq. in. and high temperatures approaching 300 deg F (149 deg C). Finished sheets trimmed and backs sanded to facilitate bonding to substrate. dimensioned or unnecessary cutouts or fixture holes.

B. Surface Burning Characteristics:
1. Test Standards: ASTM E 84, ASTM E 162, ASTM E 662, IMO FTP Code Part 2 and Part 5, and UL 723.

2. Interior Finish Classification, Fire-Rated Laminate: Class A according to NFPA 101. Flame spread less than 25 and Smoke Developed less than 450.

C. Surfaces Subject to Food Contact: Comply with NSF Standard 35.

### 2.03 STANDARD DECCORATIVE LAMINATES

A. General Purpose Laminate Product: “Wilsonart Type 107.”
1. Sheet Thickness: 0.048 inch nominal.
2. Laminate Conformance Standard: NEMA LD 3, Grade HGS.
3. Color, Pattern, and Finish: Selected from manufacturer's full range of available selections.

B. Vertical Surface Laminate Product: “Wilsonart Type 335.”
1. Sheet Thickness: 0.028 inch nominal.
2. Laminate Conformance Standard: NEMA LD 3, Grades VGS and VGP.’’
3. Color, Pattern, and Finish: Selected from manufacturer's full range of available selections.

### 2.04 DECORATIVE EDGES AND EDGEBAND

A. Decorative Edge Products: Based on “Wilsonart® Decorative Edges.”
1. Beveled Edge, **[FE Profile.]**
2. Color, Pattern, and Finish: Selected from manufacturer's full range of available selections.

B. Decorative Edgeband Products: Based on “Wilsonart® Decorative Edgeband.”
1. Composition: ABS/PVC extruded fabrication.
2. Width: As required.

3. Color, Pattern, and Finish: Selected from manufacturer's full range of available selections.

### 2.05 ACCESSORY MATERIALS

A. Contact Adhesive:
   1. Product: Low VOC Contact Adhesive
   2. Description: High solids, low VOC contact adhesive for non-postforming applications.
   3. As recommended by manufacturer for specific application.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine surfaces for conditions that could adversely affect the performance of the decorative plastic laminate installation, including edge performance.

B. Surfaces to be adhesively bonded shall be clean, dry and free of any dust, loose paint, wax, moisture, dirt, grease, oil, rust, or other contaminants.

C. Commencement of work will constitute acceptance of existing conditions and surfaces to receive the work.

### 3.02 INSTALLATION - GENERAL

A. Install materials according to referenced Specification Sections and the following conformance standards as applicable:
   1. AWI AWS.
   2. KCMA A161.1.

B. To avoid stress cracking, do not use square-cut inside corners. All inside corners to have a minimum 1/8 inch radius and all edges routed smooth.

C. Drill oversized holes for screws, bolts, and similar fasteners. Slightly countersink fasteners into face side of laminate-clad substrate.

D. Use carbide-tipped saw and router blades for cutting, with high tool speed and low feed speed. Keep cutting blades sharp. Use appropriate hold-downs to prevent vibration.

### 3.03 ADHESIVE SPRAY APPLICATIONS

A. Comply with adhesive manufacturer’s printed installation instructions.

B. Apply contact adhesive uniformly to both surfaces and with a minimum 80 percent coverage for each surface. Apply PVA adhesive to one side with a minimum 80 percent coverage.

C. Apply two coats of adhesive to porous surfaces. Provide 100 percent coverage for edges.

D. Apply uniform downward pressure (30 to 40 psi minimum) across the entire bonded surface.

### 3.04 ADHESIVE BRUSH APPLICATIONS

A. Comply with adhesive manufacturer’s printed installation instructions.

B. Apply contact adhesive uniformly to both surfaces with a brush or solvent-resistant medium nap roller; cover each surface 100 percent. Apply PVA adhesive to one side, for 100 percent coverage.

C. Provide two coats of adhesive on porous surfaces. Double coat edges.

D. Apply uniform downward pressure (30 to 40 psi minimum) across the entire bonded surface.

### 3.04 CLEANING AND PROTECTION

A. Clean decorative plastic laminate according to manufacturer's printed care and maintenance instructions.

B. Protect installed products and finish surfaces from damage during remainder of construction period.

**END OF SECTION**

# SECTION 07200

# ACOUSTICAL INSULATION

## PART 1 GENERAL

### 1.01 SUMMARY

A. Provide mineral wool sound attenuation fire batt insulation above suspended ceilings.

### 1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

1. C 665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. E 84 Test Method for Surface Burning Characteristics of Building Materials.
3. E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
4. C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
5. C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method

### 1.04 SUBMITTALS

A. Product Data: Submit product literature and installation instructions for specified insulation.

### 1.05 DELIVERY, STORAGE AND HANDLING

A. Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Label insulation packages to include material name, production date and/or product code.

C. Deliver and store materials under provision of Section 01600.

### 1.06 LIMITATIONS

A. Do not use unfaced insulation in exposed applications where there is potential for skin contact and irritation.

B. Kraft and standard foil facings will burn and must not be left exposed. The facing must be installed in substantial contact with the unexposed surface of the ceiling, wall or floor finish. Protect facing from any open flame or heat source.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Insulation:

1. Industrial insulation group, a Johns Manville Company.
2. Substitutions: See Section 01600 - Product Requirements.

**2.02 SOUND ATTENUATION FIRE BATTS**

A. Type: Unfaced mineral wool acoustical insulation complying with ASTM C 665, Type I or ASTM C553, Type 5..
B. Size: Thickness 3 ½" Wide
C. Surface Burning Characteristics:
   1. Maximum flame spread: 5
   2. Maximum smoke developed: 0 when tested in accordance with ASTM E 84.
D. Combustion Characteristics: Passes ASTM E 136.
E. Fire Resistance Ratings: Passes ASTM E 119 as part of a complete fire tested wall assembly.
F. Sound Transmission Class: Highest possible for thickness.
G. Dimensional Stability: Linear Shrinkage less than 0.1%

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified.

B. Verify mechanical and electrical services within the shaft wall have been tested and inspected.

C. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

D. Clean substrates of substances harmful to insulation.

**3.02 GENERAL INSTALLATION**

A. Comply with manufacturer's instructions for particular conditions of installation in each case.

**3.03 PROTECTION**

A. Protect installed insulation as recommended by manufacturer.

**END OF SECTION**

# SECTION 07211

# BATT INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fiberglass batt thermal insulation.

### 1.02 REFERENCES

A. Materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:

1. American Society for Testing of Materials (ASTM):

a. ASTM C423 Test Method for Sound Absorption Coefficient by the Reverberation Room Method.

b. ASTM C518 Test Method for Steady State Thermal Transmission properties by Means of the Heat Flow Meter.

c. ASTM C665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

d. ASTM C1320 Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

e. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

f. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.

g. ASTM E119 Test Methods for Fire Tests of Building Construction and Materials.

### 1.03 SUBMITTALS

A. Product Data: Submit data on product characteristics, performance criteria, and limitations, including installation instructions.

### 1.04 QUALITY ASSURANCE

A. Sustainable Design: Provide products which have received the following certifications:

1. UL Certified Environmental Product Declaration in accordance with ISO 14025. Applies to EcoTouch® Faced and Unfaced insulation.

2. GREENGUARD Formaldehyde Free, applies to EcoTouch® Unfaced and EcoTouch® Faced Batts and Rolls.

3. Scientific Certification Systems SCS-MC-02676, SCS Certified minimum 58% recycled glass content (with at least 36% post-consumer recycled and the balance of pre-consumer recycled glass content), applies to EcoTouch® Faced Batts and Rolls.

### 1.05 DELIVERY STORAGE AND HANDLING

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry indoors location. Protect insulation materials from moisture and soiling.

C. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

D. Do not install insulation that has been damaged or wet. Remove it from jobsite.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Thermal Insulation: EcoTouch® PINK® FIBERGLAS™ Insulation with PureFiber® Technology by Owens-Corning, Toledo, OH 43659; www.owenscorning.com.2.

B. Substitutions: See Section 01600 - Product Requirements.

### 2.02 MATERIALS

A. EcoTouch® Kraft Faced Batt Insulation: ASTM C 665, Type II, Class C preformed formaldehyde free glass fiber batt type, Kraft paper faced one side. Includes Kraft faced SonoBatts and EcoTouch® ProPink FastBatt Insulation.

1. ICC Building Code Construction Classification: III, IV, V.

2. Perm Rating: 1 perm maximum per ASTM E96.

E. Accessories: Provide accessories per insulating system manufacturer's recommendations, including the following:

1. Tape: Polyethylene self-adhering type for Kraft faced insulation.

### 2.03 PERFORMANCE CRITERIA

A. Metal Frame Construction, R-Value for Batt Insulation: Per ASTM C518.

1. R-19, 6-1/4 inch (159mm) thickness, 16 inch (406mm) x 48 inch (1219mm) or 96 inch (2438mm) length.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive insulation. Verify mechanical and electrical services within walls have been tested and inspected.

B. Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

A. Comply with manufacturer's installation instructions and ASTM C1320.

B. Friction-fit blanket insulation in place, until the interior finish is applied. Install batts to fill entire stud cavity, with no gaps, voids, or areas of compression. If stud cavity is less than 8 feet in height, cut lengths to friction fit against floor and ceiling tracks. Walls

with penetrations require that insulation be carefully cut to fit around outlets, junction boxes, and other irregularities.

1. Do not install insulation on top of or within 3 inches of recessed light fixtures unless the fixtures are approved for such use.

C. Within exterior wall framing, install insulation between pipes and backside of sheathing. Cut or split insulation material as required to fit around wiring and plumbing.

D. Fluff insulation to full thickness for specified R-value before installation. Do not compress insulation in the cavity during installation, creating gaps or voids that could diminish thermal value.

E. Trim insulation neatly to fit spaces. Fill miscellaneous gaps and voids with insulation.

F. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.

G. For batt insulation with factory-applied facing, install with vapor retarder membrane facing warm in the winter side of building spaces or as specified by local building code. Lap ends and side flanges of membrane over or between framing members. Tape to seal tears, cuts or misalignments in membrane.

H. Secure insulation in place using one of the following methods: Friction fit; staple or nail facing flanges in place as needed, tape in place, retain in place with spindle fasteners, retain in place with wire mesh secured to framing members.

**3.03 PROTECTION**

A. Protect installed insulation from damage due to weather and physical abuse until protected by permanent construction.

**END OF SECTION**

# SECTION 07212

# FOAM BOARD INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Board insulation at exterior walls.

### 1.02 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2010a.

B. ASTM C 518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.

1. In the event the board insulation becomes wet, wipe dry prior to installation.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Insulation:

1. Owens Corning Corp.

2. Substitutions: See Section 01600 - Product Requirements.

### 2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV; Extruded polystyrene board with cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   3. Board Size: 24 x 96 inch (610 x 2440 mm).
   4. Board Thickness: 1 inch.
   5. Board Edges: Square.
   6. Thermal Conductivity (k factor) at 25 degrees F (-3.9 degrees C): 0.18 (0.31).
   7. Compressive Resistance: 25 psi.
   8. Board Density: 1.55 lb/cu ft (26 kg/cu m).
   9. Water Absorption, maximum: 0.3 percent, volume.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### 3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Place 6 inch (150 mm) wide polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frames. Tape seal in place to ensure continuity of vapor retarder and air seal.

D. Tape insulation board joints.

### 3.03 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

# SECTION 07216

# CONTINUOUS INSULATION BOARD

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Exterior wall insulation board.

### 1.02 REFERENCE STANDARDS

A. Reference standards:

1. ASTM International (ASTM):

a. ASTM C203-[99]: Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

b. ASTM C209-[98]: Test Method for Cellulosic Fiber Insulating Board.

c. ASTM C1289-[06]: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

d. ASTM D1621-[04a]: Test Method for Compressive Properties of Rigid Cellular Plastics.

e. ASTM D1622-[03]: Test Method for Apparent Density of Rigid Cellular Plastics.

h. ASTM D2126-[99]: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

i. ASTM E84-[05]: Test Method for Surface Burning Characteristics of Building Materials.

j. ASTM E96/E96M-[05]: Test Method for Water Vapor Transmission of Materials.

k. ASTM E331-[00]: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

l. ASTM E 2357-[05]: Test Method for Determining Air Leakage of Air Barrier Assemblies.

2. Factory Mutual (FM):

a. FM 4880: Class I Wall and Ceiling Panels Building Corner Fire Test.

3. Underwriters Laboratories Inc. (UL):

a. UL 723: Surface Burning Characteristics of Building Materials.

4. National Fire Protection Association (NFPA):

a. NFPA 285 [2006]: Standard Method of Test for the Evaluation of Flammability

Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

### 1.03 SYSTEM DESCRIPTION

A. Performance Characteristics:

1. Thermal performance:

a. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 per inch of thickness with a minimum six month exposure capability to outdoor elements [and 15 year thermal warranty].

2. Air barrier performance: When tested in accordance with ASTM E2357, at a test pressure of

not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2 L/s*m2) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25psf.

3. Water penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.

4. Mold resistance: Thermal wall system components shall provide non-food source for fungal growth.

B. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:

1. Exterior Insulation:

a. Class 1 (<and/or= 25 Flame Spread Index and < 450 Smoke Developed Index) classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.

b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.

2. System complies with ASTM E2357-[05]: Test Method for determining Air Leakage of Air Barrier Assemblies.

C. Fire Resistance:

1. System complies with NFPA 285 [2006]: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

2. Fire-stopping measures, per code, should be included at the floor line in the stud cavity when the wall assembly extends beyond the edge of the floor line.

D. All joints, penetrations and gaps of the thermal wall system shall be made watertight and air-tight.

**1.04 SUBMITTALS**

A. Product Data: Submit manufacturer's product data and installation instructions for each thermal wall system component product required.

B. At bid submission, provide the following evidence to the Architect:

1. Thermal and Air Barrier Wall System Manufacturer Contractor Accreditation

a. Acceptable Accreditation Methods:

1) Dow Thermax Wall System Accreditation Program

2) Or Equal

C. Reports:

1. Submit Test Reports, summarized by Manufacturer of material(s), verifying qualities of thermal wall system components meet or exceed specified requirements.

a. Include results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.

b. Include mill certificates indicating steel framing sheet complies with the specified requirements.

2. Submit Field Inspection and Test Reports in accordance with Field Quality Control

requirements.

D. Samples: Submit following material samples.

1. Insulation panel, 12" square.

2. Insulation fasteners/washers and joint flashing tape, one each.

E. Submit Material Safety Data Sheets (MSDS) for thermal barrier wall system components.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A. Deliver materials in manufacturer's original packaging.

B. Store and protect products in accordance with manufacturer's instructions. Store in a dry area and protect from water, direct sunlight, flame, and ignition sources. Do not install insulation that has been damaged or wet.

1. In the event the board insulation becomes wet, wipe dry prior to installation.

**1.06 WARRANTY**

A. Submit the following warranties:

1. Exterior Insulation Board: Six month exposure and 15 year thermal warranty.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. The Dow Chemical Company 2030 Willard H. Dow Center Midland, MI 48674 United States.

B. Substitutions: See Section 01600 - Product Requirements.

**2.02 FOAM BOARD INSULATION MATERIALS**

A. Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil embossed white or blue acrylic-coated aluminum on one side and 1.25 mil embossed aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:

1. ASTM C1289 Type 1, Class 2

2. Compressive Strength (ASTM D1621): 25 psi, minimum.

3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): [R-6.5 at 1 inch] [RSI 1.06 per 25 mm] of thickness [with 15 year thermal warranty]

4. Flexural Strength (ASTM C203): Minimum 40 psi.

5. Water Absorption (ASTM C209): Maximum.1.0 percent by volume.

6. Water Vapor Permeance (ASTM E96): <0.3 perms.

7. Maximum Use Temperature: 250 degrees F.

B. Acceptable Products: The Dow Chemical Company "THERMAX™ ci Exterior Insulation."

1. Panel Size: 4'-0" wide x 8'-0" [12'-0"] long, square edge, shiplap.

2. Thickness and Stabilized R-Value: Nominal 1.0 inch thickness, R-6.5

C. Accessories:

1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.

a. Acceptable Products: Wind-lock Corporation "ci-Lock Steel Series Selection" with 1-3/4 inch diameter high-grade plastic washers.

2. Fluid-applied flashing and Sealant: Provide manufacturer's LIQUIDARMOR, fluid-applied flashing and sealant for sealing joints, seams, corners, at opening perimeter, at opening head, jamb and sill condition and penetrations through the insulation layer.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.

1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within thermal wall system alignment tolerances and requirements.

2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.

3. Verify that items required to penetrate the thermal wall system are placed and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.

4. Do not proceed with thermal wall system installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

### 3.02 INSULATION INSTALLATION AT EXTERIOR WALLS

A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.

2. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8" from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 1.75" diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.

3. Install fluid-applied flashing system and sealant equal to either LiquidArmor CM Flashing and Sealant or LiquidArmor LT Flashing and Sealant as recommended by manufacturer per application. Install as per manufacturer's instructions.

a. LIQUIDARMOR™ CM Flashing and Sealant

1) Surface and ambient temperatures should be 35 degree F and rising and below 120degree F during the application.

2) Do not apply product on surfaces with standing water or frost.

3) LIQUIDARMOR™ CM tolerates rain shortly after the curing process has begun (allow 24 hours depending on conditions), avoid installing on days with a

high probability of significant rainfall.

4) Seal any gaps greater than ¼ inches with GREAT STUFF PRO™ Window and Door Insulating Foam Sealant or compatible sealant according to Manufacturer's recommendations, prior to applying LIQUIDARMOR™ CM. If facer on insulation board is damaged note the affected area so that additional spray can be applied appropriately. Damaged insulation can also be replaced or Dow Flashing can be used to repair facer flaws.

5) Flash board joints, penetrations and other fenestration openings as required with a minimum 50 wet mils (+/-5 mils). Spray can be applied on one or two passes depending on site conditions.

6) Apply 3 inches (+/-1 inch) over the board joints. Make sure that a minimum of 1 inch of spray covers each side of the joint. Fasteners and washers along the board joints should also be completely covered with LIQUIDARMOR™ CM. Brick anchors can be installed after the application of LIQUIDARMOR™CM.

7) For rough openings apply LIQUIDARMOR™ CM a minimum of 3 inches onto the sheathing face, completely covering the sheathing board edge. In turn extend spray a minimum of 3 inches back onto the rough opening substrate. It is recommended to cover a distance back onto the rough opening equal to what is covered by traditional flashing materials.

8) For penetrations through the rigid insulation or substrate apply LIQUIDARMOR™ CM a minimum of 2 inches onto the sheathing face and a minimum of 2 inches onto the penetration substrate or primary flashing substrate.

9) Use wet mil thickness gauge to ensure proper installation thickness. A paint brush can be used to even out product application thickness. If product is consistently below minimum thickness spray another pass to achieve proper thickness requirements.

10) LIQUIDARMOR™ CM typically cures to dry to touch within 1 to 4 hours after application, but depending on humidity, temperature, sun exposure and wind direction this time can be longer. Application will dry to an approximate 30 mil thickness when completely cured.

b. LIQUIDARMOR™ LT Flashing and Sealant

1) Surface and ambient temperatures should be -20 deg F and rising and below 120 deg F during the application.

2) Do not apply product to surfaces with standing water, continuously immersed in water or frost.

3) LIQUIDARMOR™ LT flashing & sealant tolerates rain within 15 minutes of installation.

4) Seal any gaps greater than ¼ inches with GREAT STUFF PRO Window and Door Insulating Foam Sealant or compatible sealant according to Manufacturer's recommendations, prior to applying LIQUIDARMOR™ LT. If facer on insulation board is damaged note the affected area so that additional flashing can be applied appropriately. Damaged insulation can also be replaced or Dow Flashing can be used to tape down facer flaws.

5) Trowel board joints, penetrations and other fenestration openings as required with a minimum 30 wet mils (+/-5 mils).

6) Apply minimum of 1 inch over the board joints. Make sure that a minimum of

1/2 inch of silicone flashing covers each side of the joint. Fasteners and washers along the board joints should also be sealed with LIQUIDARMOR™ LT. When covering the fasteners and washers, extend the LIQUIDARMOR™ LT 1 inch onto the substrate from the outer perimeter edge of the washer. Brick anchors can be installed after the application of LIQUIDARMOR™LT.

7) For rough openings apply LIQUIDARMOR™ LT a minimum of 3 inches onto the sheathing face, completely covering the sheathing board edge. In turn extend the silicone flashing a minimum of 3 inches back onto the rough opening substrate or 1 inch behind where the primary air and water seal is to be installed, whichever is greater.

8) It is recommended to cover a distance back onto the rough opening equal to what is covered by traditional flashing materials.

9) For penetrations through the rigid insulation or substrate apply LIQUIDARMOR™LT a minimum of 2 inches onto the sheathing face and a minimum of 2 inches onto the penetration substrate or primary flashing substrate.

10) After application, ensure a consistent film thickness and visually inspect for missed spots. Use wet mil thickness gauge to ensure proper installation thickness.

11) Allow LIQUIDARMOR™ LT flashing and sealant to “dry-to-touch”- typically skins over in 30 – 45 minutes of application

**3.03 PROTECTION**

A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

# SECTION 07240

# EXTERIOR INSULATION AND FINISH SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Composite wall and soffit cladding of rigid insulation and reinforced finish coating (Class PB).

### 1.02 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2009.

B. ASTM C150 - Standard Specification for Portland Cement; 2011.

C. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2004 (Reapproved 2010).

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2010a.

E. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2005 (Reapproved 2010).

F. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2011.

G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

J. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2004 (Reapproved 2010).

K. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2005a.

L. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009.

M. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2004 (Editorially revised 2009).

N. NFPA 259 - Standard Test Method for Potential Heat Building Materials; 2009.

O. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2007.

P. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2006.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

C. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

D. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques,

and jointing requirements.

### 1.04 QUALITY ASSURANCE

A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site at all times during installation.

B. EIFS Manufacturer Qualifications: Provide all EIFS products other than insulation from the same manufacturer with qualifications as follows:
   1. Member in good standing of EIMA (EIFS Industry Members Association).
   2. Manufacturer of EIFS products for not less than 5 years.

C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.

D. Installer Qualifications: Company specializing in EIFS work, with not less than three years of documented experience, and approved by the EIFS manufacturer.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Protect adhesives and finish materials from freezing and temperatures in excess of 90 degrees F (32 degrees C).
   1. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
   2. Protect insulation materials from exposure to sunlight.

### 1.06 FIELD CONDITIONS

A. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

B. Do not install coatings or sealants when ambient temperature is below 40 degrees F (5 degrees C).

C. Do not leave installed insulation board exposed to sunlight for extended periods of time.

### 1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Dryvit; System Outsulation Barrier System.

B. Other Acceptable Manufacturers:
   1. Substitutions: See Section 01600 - Product Requirements.

### 2.02 EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: BARRIER type; reinforced finish coating on insulation board adhesive-applied direct to substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate in tested samples.

B. Allowable Wind Loading: At least code minimum psf, positive and negative, determined in accordance with ICC-ES AC 219 or AC 235, using factor of safety of 3.0.

C. Fire Characteristics:
   1. Flammability: Pass, when tested in accordance with NFPA 285.

2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot (mJ/sq m).

D. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf (299 Pa) differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

E. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches (100 by 150 mm ) in size.

F. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC 219 or 235.

G. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycle 1, 5, or 9.

H. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

I. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

J. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 500 liters of sand.

**2.03 MATERIALS**

A. Base Coat: Fiber-reinforced, polymer-based product compatible with insulation board and reinforcing mesh.

B. Insulation Board: Molded, expanded polystyrene board; ASTM C578, Type II; with the following characteristics:
1. Board Size: 24 by 48 inches (610 by 1220 mm).
2. Board Size Tolerance: plus/minus 1/16 inch (1.5 mm) from square and dimension.
3. Board Thickness: As indicated on drawings.
4. Thickness Tolerance: plus/minus 1/16 inch (1.5 mm) maximum.
5. Board Edges: Square.
6. Thermal Resistance (R factor per 1 in at 75 degrees F (24 degrees C): 5.00.
7. Board Density: 1.55 lb/cu ft (26 kg/cu m).
8. Compressive Resistance: 25 psi.
9. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.

## PART 3 EXECUTION

### 3.01 GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.

B. Where different requirements appear in either document, comply with the most stringent.

C. Neither of these documents supercedes the provisions of the Contract Documents that define the contractual relationships between the parties or the scope of work.

### 3.02 EXAMINATION

A. Verify that substrate is sound and free of oil, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. Verify that substrate surface is flat, with no deviation greater than 1/4 in (6 mm) when tested with a 10 ft (3 m) straightedge.

### 3.03 INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

C. On wall surfaces, install boards horizontally.

D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch (1.6 mm).

E. Rasp irregularities off surface of installed insulation board.

F. Adhesive Attachment: Use method recommended by EIFS manufacturer.

### 3.04 INSTALLATION - FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at all terminations of the EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
   1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches (64 mm).
   2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

C. Apply sealant at finish perimeter and expansion joints in accordance with Section 07900.

### 3.05 CLEANING

A. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

### 3.06 PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

**END OF SECTION**

# SECTION 07410

# METAL ROOF PANELS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Mechanically-seamed, standing seam metal roof panels, with related metal trim and accessories

### 1.02 REFERENECES

A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:

1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
2. AAMA 809.2 - Voluntary Specification Non-Drying Sealants.

B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM A 980 - Standard Specification for Steel, Sheet, Carbon, Ultra High Strength Cold Rolled.
5. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
6. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
7. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
10. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
11. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
12. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
13. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. International Accreditation Service (IAS):

1. IAS AC 472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

E. Underwriters Laboratories, Inc. (UL): www.ul.com:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Prior to erection of framing, conduct pre-installation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections and openings and penetrations and manufacturer's accessories with installation of metal panels.

## 1.04 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472 Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

a. Product data, including certified independent test data indicating compliance with requirements.
b. Samples of each component.
c. Sample submittal from similar project.
d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
e. Sample warranty.
f. IAS AC 472 certificate.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.

C. Installer Qualifications: Experienced Installer [certified by metal panel manufacturer] with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic [certified by metal panel manufacturer] supervising work on site whenever work is underway.

D. **Buy American Compliance**: Materials provided under work of this Section shall comply with the following requirements:

1. Buy American Act of 1933 BAA-41 U.S.C §§ 10a – 10d.
2. Buy American provisions of Section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA).

## 1.05 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include data indicating compliance with performance requirements.
3. Include structural data indicating compliance with requirements of authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch long section of each metal panel profile. Provide color chip verifying color selection.

**1.06 INFORMATIONAL SUBMITTLAS**

A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC 472.

D. **Buy American Certification**: Manufacturers' letters of compliance acceptable to authorities having jurisdiction, indicating that products comply with requirements.

E. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

**1.07 CLOSEOUT SUBMITTALS**

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

**1.08 DELIVERY, STORAGE AND HANDLING**

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

**1.09 COORDINATION**

A. Coordinate sizes, profiles, and locations of roof curbs and other roof-mounted equipment and roof penetrations, based upon sizes of actual selected equipment.

**1.10 WARRANTY**

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

B. **Special Weathertightness Warranty**: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, without monetary limitation within 20 years from date of Substantial Completion.

C. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within [25] years from date of Substantial Completion, including:

1. Fluoropolymer Two- Coat System:

a. Color fading in excess of 10 Hunter units per ASTM D 2244.
b. Chalking in excess of No. 6 rating per ASTM D 4214.
c. Failure of adhesion, peeling, checking, or cracking.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.**; Houston TX. Tel: (877)713-6224; Email: info@mbci.com; Web: www.mbci.com.

1. Provide basis of design product, or comparable product approved by Architect prior to bid.

### 2.02 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:

1. Wind Loading: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on structural drawings.

a. Wind Uplift Testing: Certify capacity of metal panels by actual testing of proposed assembly per ASTM E 1592.

2. Snow Loads: As indicated on structural drawings.
3. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection as specified on drawings with no evidence of failure.
4. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."

C. Wind Uplift Resistance: Comply with UL 580 for wind-uplift class [UL-30] [UL-60] [UL-90].

D. Air Infiltration, ASTM E 1680: Maximum 0.25 cfm/sq. ft. at static-air-pressure difference of 6.24 lbf/sq. ft. or as required by local code (most restrictive).

E. Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 12 lbf/sq. ft..

F. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

## 2.03 METAL ROOF PANELS

A. Mechanically-seamed, Concealed Fastener, Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with vertical ribs at panel edges, installed by lapping and mechanically interlocking edges of adjacent panels, and attaching panels to supports using concealed clips and fasteners in a weathertight installation.

1. Basis of Design: MBCI, BattenLok HS, www.mbci.com/battenlokHS.html.

a. Nominal Coated Thickness: 24 gage.

b. Panel Surface: Smooth with striations in pan.
c. Exterior Finish: Fluoropolymer two-coat system.
d. Color: As selected by Architect from manufacturer's standard colors.

## 2.04 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings, in [manufacturer's standard profiles] [profiles as indicated]. Provide required fasteners, closure strips, thermal spacers, splice plates, support plates, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Clips: Provide panel clip of type specified, at spacing indicated on approved shop drawings.

1. Two-piece Floating: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

2. Single-Piece Fixed: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-tapping screws and other acceptable corrosion-resistant fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.

E. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:

1. Factory-Applied Seam Sealant: Manufacturer's standard hot-melt type.

2. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.

F. Snow Guards: Approved by metal roof panel manufacturer.

**2.05 FABRICATION**

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept factory-applied sealant providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.

C. Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

**2.06 FINISHES**

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.
1. Basis of Design: MBCI, Signature 300.

C. Interior Finish: 0.5 mil (0.013 mm) total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.

1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.

2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:

a. 1/4 inch (6 mm) in 20 foot (6.1 m) in any direction.

b. 3/8 inch (9 mm) over any single roof plane.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

**3.02 PREPARATION**

A. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.

B. Flashings: Provide flashings as required to complete metal roof panel system. Install in accordance with Section 07 62 00 "Sheet Metal Flashing and Trim" and approved shop drawings.

**3.03 METAL PANEL INSTALLATION**

A. Mechanically-Seamed, Standing Seam Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.

1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
3. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

**3.04 ACCESSORY INSTALLATION**

A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Provide concealed fasteners except where noted on approved shop drawings.
4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.

1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

**3.05 FIELD QUALITY CONTROL**

A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

**3.06 CLEANING AND PROTECTION**

A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

**END OF SECTION**

# SECTION 07620

# SHEET METAL FLASHING AND TRIM

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Reglets and accessories.

### 1.02 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

E. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

F. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

G. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

### 1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

## PART 2 PRODUCTS

### 2.01 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B 209 (ASTM B 209M); 0.032 inch (0.8 mm) thick; plain finish shop pre coated with fluoropolymer coating of color as selected.
   1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.

### 2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

D. Sealant: Type as specified in Section 07900.

E. Plastic Cement: ASTM D4586, Type I.

### 2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same type sheet metal, minimum 1-1/2 inches (38 mm) wide, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

### 3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

### 3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

B. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

**END OF SECTION**

# SECTION 07650

# FLEXIBLE FLASHING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Self-adhering rubberized asphalt flashings.

### 1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets showing product characteristics and including installation instructions.

### 1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company with at least five years of successful experience in weathertight installation of flashing.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's sealed containers and packaging, bearing manufacturer's name and product identification.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Acceptable Manufacturer: Sandell Manufacturing Company, Inc; 310 Wayto Rd., Schenectady, NY 12303. ASD. Tel: (518) 357-9757. Fax: (518) 357 9636.

### 2.02 MATERIALS

A. Flexible Flashing: Sando-Seal Self-Adhering Flashing; 40 mil (1.02 mm) thick membrane comprised of 32 mils (0.8 mm) of highly adhesive rubberized asphalt integrally bonded to an 8 mil (0.22 mm) high density, cross laminated polyethylene film.

B. Primer: Manufacturer's special primer formulated to prepare surfaces for self-adhering flashing.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces to receive flashing are thoroughly dry, free from loose materials, and reasonably smooth, with no sharp edges or projections.

B. Verify that locations to receive flashing are sloped so water that enters will drain to building exterior.

### 3.02 PREPARATION

A. Self-Adhering Flashing: Prime all surfaces to receive self-adhering flashing, and allow to dry for not less than 20 minutes prior to flashing application.

### 3.03 INSTALLATION

A. General: Comply with recommendations of SMACNA Architectural Sheet Metal Manual.
   1. Lap joints minimum of 4 inches (100 mm) and seal watertight with mastic.
   2. Carry flashing vertically as detailed, but not less than 6 inches (150 mm) above horizontal plane.
   3. Extend head and sill flashings not less than 6 inches (150 mm) beyond edges of openings and turn up to form watertight pan; seal with mastic.

B. Coordination: Interface flashing work with adjacent and adjoining work to ensure best possible weather resistance and durability of completed flashing.

C. Masonry Flashing: Lay horizontal flashing in slurry of fresh mortar and top with fresh full bed of mortar to receive masonry units. At vertical surfaces, spot flashing with mastic to hold in place until masonry has set.
   1. Carry flashing through wall and leave exposed for inspection.
   2. After inspection, cut flashing flush with surface of masonry.
   3. Remove mortar or other obstructions from weep holes at flashing locations.

**END OF SECTION**

# SECTION 07720

# SNOW GUARDS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Standing seam attachment bracket.

B. Guard bar.

### 1.02 SYSTEM DESCRIPTION

A. Attachment Bracket:

1. Components – Standing seam attachment bracket consists of the following:
   a. aluminum block;
   b. 2 stainless steel set screws;
   c. 1 stainless steel flat head bolt;
   d. 1 stainless steel lock washer.
2. Design Requirements:
   a. Spacing to be recommended by manufacturer or building engineer.
   b. Install a minimum of 2 set screws per bracket.
   c. Verify system is acceptable by roofing manufacturer.

B. Guard Bar:

1. Components and system to include the following:
   a. Aluminum bar;
   b. Aluminum coupling / splice plate;

### 1.03 SUBMITTALS

A. Submit manufacturer's specifications, standard details drawings, installation instructions and recommended layout.

### 1.04 QUALITY ASSURANCE

A. Installer to be experienced in the installation of specified roofing material and snow guards for not less than 5 years in the area of the project.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

A. Alpine SnowGuards. A division of Vermont Slate & Copper Services Inc. 289 Harrel St. Morrisville, VT 05661, (888) 766-4273 www.alpinesnowguardsProvide basis of design product, or comparable product approved by Architect prior to bid.

B. Substitutions: See Section 01600 - Product Requirements

### 2.02 MATERIALS

A. Standing seam attachment bracket.

1. Bracket: 6000 Series Aluminum;

2. Set Screws: 304 stainless steel 18.8 alloy;

3. Stainless Steel Flat Head Bolt – 304 stainless steel 18.8 alloy;

4. Stainless Steel Lock Washer – 18.8 stainless steel

B. Guard bar.

1. Bar: 6000 Series Aluminum;

2. Coupling/Splice Plate – 6000 Series Aluminum;

**2.03 FINISH**

A. Mill finish for both bracket and bar guard.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

A. Substrate:

1. Inspect structure on which snow guard system is to be installed and verify that it will withstand any additional loading that it may incur. Notify general contractor of any deficiencies before installing system.

2. Verify that roofing material has been installed correctly prior to installing snow guards. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings.

**3.02 INSTALLATION**

A. Comply with architectural drawings, roofing manufacturer’s requirements and snow guard manufacturer’s recommendations for location of system. Comply with manufacturer's written installation instructions for installation and layout.

**END OF SECTION**

# SECTION 07900

# JOINT SEALERS

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes:

1. Liquid joint sealants.
2. Preformed joint sealants.
3. Weather barrier transitions.

### 1.02 REFERENCE STANDARDS

A. ASTM International (ASTM): www.astm.org:

1. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
2. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
3. ASTM C834 - Specification for Latex Sealants.
4. ASTM C 920 - Specification for Elastomeric Joint Sealants.
5. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
6. ASTM C 1193 - Guide for Use of Joint Sealants.
7. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
8. ASTM C 1311 - Specification for Solvent Release Sealants.
9. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
10. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
11. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
12. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.
13. ASTM E 283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
14. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

B. NSF International (NSF): www.nsf.org:

1. Standard 51: Food Equipment Materials.

C. Sealant, Waterproofing, and Restoration Institute (SWRI): www.swrionline.org:

1. SWRI Validation Program.

D. U. S. Environmental Protection Agency (EPA): www.epa.gov:

1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.

E. U.S. Food and Drug Administration (FDA): www.fda.gov:

1. 21 CFR 177.2600: Title 21 Part 177 Indirect Food Additives: Polymers.

F. US Green Building Council (USGBC): www.usgbc.org

1. Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

## 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

## 1.04 ACTION SUBMITTALS

A. Product Data: For each type of joint sealant product specified, including:

1. Preparation instructions and recommendations.
2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

B. Joint Sealant Schedule: Indicate joint sealant location, joint sealant type, manufacturer and product name, and color, for each application. Utilize joint sealant designations included in this Section.

C. Samples for Color Selection: For each joint sealant type.

D. Samples for Verification: For each exterior joint sealant product, for each color selected.

## 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified applicator.

B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

C. Preconstruction compatibility and adhesion test reports.

D. Preconstruction field-adhesion test reports.

E. Field quality control adhesion test reports.

F. Warranty: Sample of unexecuted manufacturer and installer special warranties.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installer equipped and trained for application of joint sealants required for this Project with record of successful completion of projects of similar scope.

B. Single Source Responsibility: Provide exterior joint sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit [four] samples of each material that will be in contact with or affect joint sealants. Test sealants with substrate materials using ASTM C794 or manufacturer's standard test methods to

determine requirements for joint preparation, including cleaning and priming. Test sealants with related materials to verify compatibility.

D. Preconstruction Field-Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C1193 Method A or method recommended by manufacturer. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Architect.

E. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

## 1.07 WARRANTY

A. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.

1. Warranty Period: [Two] years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

A. Basis-of-Design Product: Provide joint sealant products manufactured by Dow Corning Corporation, Midland MI; (877) SEALANT, (877) 732-5268; email: construction@dowcorning.com; website: www.dowcorning.com/construction, [or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements].

## 2.02 MATERIALS - GENERAL

A. VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.

C. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid-applied joint sealant.

D. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.

E. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

## 2.03 LIQUID JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T, NT; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 790 Silicone Building Sealant**.
2. Hardness, ASTM C 661: 15 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 26 g/L maximum.
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 10 colors] [

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 756 SMS Building Sealant**.
2. Hardness, ASTM C 661: 35 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 60 g/L maximum
4. Staining, ASTM C 1248: None on white marble.
5. Color: As selected by Architect from manufacturers full line of not less than 8.
6. DOW CORNING® 756 SMS Building Sealant is a one-component, medium-modulus, neutral cure silicone sealant suitable for weatherproofing porous stone, metal panels, curtain wall framing, and other above-grade expansion and control joints for both new and remedial construction. Volatile Organic Compound (VOC) Content: 60 g/L maximum.

C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, M, and A; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 791 Silicone Weatherproofing Sealant**.
2. Hardness, ASTM C 661: 34 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 30 g/L maximum
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 6 colors.
6. DOW CORNING® 791 Silicone Weatherproofing Sealant is a one-component, medium-modulus, neutral-cure silicone sealant for general glazing and above-grade weathersealing in curtainwalls and building facades for both new and remedial construction. Product complies with GSA Commercial Item Descriptions CID A-A-272B. Volatile Organic Compound (VOC) Content: 30 g/L maximum.

D. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, A, and O; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 795 Silicone Building Sealant**.
2. Hardness, ASTM C 661: 35 - 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 32 g/L maximum
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturers full line of not less than 10.
6. DOW CORNING® 795 Silicone Building Sealant is a one-component, medium modulus, neutral-cure, silicone sealant for structural and non-structural glazing, structural attachment for panel systems, as well as above-grade weathersealing joints with most common constructions materials for both new and remedial construction. Product complies with GSA Commercial Item Descriptions CID A-A-272B. Volatile Organic Compound (VOC) Content: 32 g/L maximum.

E. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 995 Silicone Structural Sealant**.
2. Hardness, ASTM D 2240: 35 - 45 durometer Shore A
3. Volatile Organic Compound (VOC) Content: 34 g/L maximum
4. Ultimate Tensile, ASTM C 1135: 160 psi (1.1 MPa), at 21 day cure (TA Joint).
5. Color: As selected by Architect from manufacturers full line of not less than 3 colors.

6. DOW CORNING® 995 Silicone Structural Sealant is designed for excellent adhesion in structural applications, including factory or field glazing. It adheres to glass, reflective glass, anodized aluminum, granite and most paints, including fluoropolymer-based paints. It exhibits a medium modulus, which offers an extremely high tensile adhesion strength. Ideal for use as a glazing sealant in high-performance protective window systems that increase personal safety from flying glass. Tolerates the differential thermal and windload movements found in structural glazing applications and the severe stresses required of an impact-resistant glazing product. Product complies with GSA Commercial Item Descriptions CID A-A-272B. Volatile Organic Compound (VOC) Content: 34 g/L maximum.

F. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.

1. Basis of Design Product: **DOW CORNING® 758 Silicone Weather Barrier Sealant**.
2. Hardness, ASTM D 2240: 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 61 g/L maximum
4. Color: White.
5. DOW CORNING® 758 Silicone Weather Barrier Sealant is a one-component, neutral-cure silicone sealant for above-grade joints with compatibility and strong adhesion to a wide array of common construction materials, including peel-and-stick window flashings, building wraps, polyolefins, and PVCs for both new and remedial construction. Volatile Organic Compound (VOC) Content: 61 g/L.

G. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant **JS#**__: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Basis of Design Product: **DOW CORNING® 999-A Silicone Building & Glazing Sealant**.
2. Hardness, ASTM D 2240: 25 durometer Shore A minimum.
3. Volatile Organic Compound (VOC) Content: 36 g/L maximum
4. Ultimate Tensile, ASTM D 412: 325 psi (1.2 MPA) at 21 day cure (Dumbbell)
5. Color: As selected by Architect from manufacturers full line of not less than 6.
6. DOW CORNING® 999-A Silicone Building & Glazing Sealant is a one-part, weather-resistant silicone sealant formulated for a wide range of building construction applications. It is particularly effective for glazing butt and lap shear joints and sealing curtainwall and other glass, plastic and metal assemblies. It can also be factory applied as a primary seal to glass, plastic, and metal assemblies. 999-A is not suitable for structural glazing. It is compatible with acrylic and polycarbonate glazing sheets and one-part DOW CORNING® brand silicone construction sealants. It is also compatible with most laminated glass. A 10 year general product limited warranty is available. Volatile Organic Compound (VOC) Content: 36 g/L maximum.

H. Mildew-Resistant, Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Basis of Design Product: **DOW CORNING® 786 Silicone Sealant**.
2. Hardness, ASTM D 2240: 25 durometer Shore A
3. Volatile Organic Compound (VOC) Content: 36 g/L maximum.
4. NSF Standard 51 and FDA Regulation No. 21 CFR 177.2600 compliant.
5. Color: As selected by Architect from manufacturer's standard colors.
6. DOW CORNING® 786 Silicone Sealant is a one-component, silicone rubber sealant that is mildew resistant when cured and is suitable for sealing tubs, showers, sinks, porcelain, cultured marble, glass, painted areas, and other nonporous surfaces and plumbing fixtures for both new and remedial construction. 786 is available in clear, white, translucent white, gray, and almond. Not for use in contact with brass or copper.

I. Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   1. for interior, non-moving, paintable joints.

J. Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
   1. for interior and exterior concealed joints within metal assemblies.

## 2.04 PRE-FORMED JOINT SEALANTS

A. Preformed Silicone Elastomer Extrusion: Highly flexible low-modulus flashing and transition material for bonding to substrates with silicone sealant. SWRI validation.

   1. Basis of Design Product: **DOW CORNING® 123 Silicone Seal**.
   2. Surface: [Smooth matte] [Textured] [Grooved to facilitate bending].
   3. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
   4. Hardness, ASTM D 2240: 25 durometer Shore A, minimum.
   5. Color: As selected by Architect from manufacturer's full line.
   6. DOW CORNING® 123 Silicone Seal is an extruded sheet product used for flashing and transitions in new construction and as a joint overlay in joint sealant rehabilitation work. It is available in widths of 1 - 12 inches (25 - 305 mm). Indicate required widths on drawing details. It is available in 6 standard colors and custom colors.. It is available in 6 standard colors and custom colors. Volatile Organic Compound (VOC) Content: 0 g/L

B. Preformed Silicone Elastomer Custom Two- and Three- Dimension Extrusion: Highly flexible flashing and transition material for bonding to substrates with silicone sealant.

   1. Basis of Design Product: **DOW CORNING® 123 Silicone Seal Custom Designs H.C**.
   2. Formulation: [General Purpose] [High Tear].
   3. Shape: Multi-dimensional as indicated on drawings and approved shop drawings and as required to fit and functionally seal specific application and prevent air and water penetration
   4. Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
   5. Color: As selected by Architect from manufacturer's full line.
   6. DOW CORNING® 123 Silicone Seal Custom Designs H.C. is preformed, custom-designed and fabricated, two- and three-dimensional, shaped silicone elastomer extrusion for repair of failed sealant joints or use in new construction splices, mitered joints (boots), and molded corners. Volatile Organic Compound (VOC) Content: 0 g/L

## 2.05 WEATHER BARRIER TRANSITIONS

A. Silicone Elastomer Weather Barrier Transition: Highly flexible clear flashing and transition strip and pre-molded corners for bonding with silicone sealant to weather barrier substrates and to adjacent curtain wall, storefront, and window frames and other transition substrates.

   1. Basis of Design Product: **DOW CORNING® Silicone Transition Strip (STS)**.
   2. Hardness, ASTM D 2240: 50 - 60 durometer Shore A.
   3. Color: Translucent
   4. Air Infiltration, ASTM E 283: Maximum 0.025 cfm/sq. ft. (0.127 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa).
   5. Water Penetration under Static Pressure, ASTM E 331: None at 15 lbf/sq. ft. (720 Pa).
   6. Movement Capability: Not less than plus 200, minus 75 percent.
   7. Tensile Strength, ASTM D 412: Not less than 800 psi (5.5 MPa).
   8. Tear Strength, ASTM D 624: Not less than 200 psi (16 kN/m).
   9. Elongation, ASTM D 412: Not less than 400 percent.
   10. Bonding Sealant: Manufacturer's recommended neutral-curing silicone

## 2.06 ACCESSORIES

A. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

B. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

C. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufacturer.

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with joint sealant work once conditions meet sealant manufacturer's recommendations.

## 3.02 PREPARATION

A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer.

1. Remove laitance, form-release agents, dust, and other contaminants.
2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.

## 3.03 SEALANT APPLICATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

C. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

D. Joint Backing: Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.

1. Install bond breaker tape over substrates when sealant backings are not used.

E. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.

1. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.
2. Using tooling agents approved by sealant manufacturer for application.

F. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.

1. Remove masking tape immediately after tooling joint without disturbing seal.
2. Remove excess sealant from surfaces while still uncured.

## 3.04 PREFORMED JOINT SEALANT APPLICATION

A. Preparation: Prepare surfaces in accordance with sealant manufacturer's written instructions. Perform field adhesion testing to determine need for application of primer. Clean surfaces to dust free, and perform solvent wipe where recommended. Mask edges of surface to be treated.

B. Application: Apply bead of recommended liquid joint sealant to each side of joint in bead size recommended by manufacturer. Press extrusion into sealant using roller to ensure uniform and complete contact. Lap vertical and horizontal joints as indicated in manufacturer's instructions. Trim preformed joint sealant. Remove masking tape and excess sealant.

## 3.05 WEATHER BARRIER TRANSITION APPLICATION

A. Preparation: Prepare field of weather barrier surface and surface of adjacent substrate in accordance with sealant manufacturer's written instructions. Perform field adhesion testing to determine need for application of primer. Clean surfaces to dust free, and perform solvent wipe where recommended.

B. Application: Apply bead of recommended liquid joint sealant to each side of joint in bead size recommended by manufacturer. Press transition extrusion into sealant using roller to ensure uniform and complete contact. Lap vertical and horizontal joints as indicated in manufacturer's instructions. Trim transition material. Remove excess sealant.

## 3.06 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer’s instructions and with ASTM C 1193, Method A.

1. Perform [5] tests for the first [1000 feet (300 m)] of joint length for each kind of sealant and joint substrate, and one test for each [1000 feet (300 m)] of joint length thereafter or 1 test per each floor per building elevation, minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

C. Submit report of field adhesion testing to Architect indicating tests, locations, dates, results, and remedial actions taken.

## 3.07 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior construction joints in cast-in-place concrete.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant:
   a. DOW CORNING® 790.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Exterior movement joints in concrete unit masonry.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790 or 795
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Exterior movement joints in brick masonry.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790 or 795
2. Joint-Sealant Color, Vertical Joints: Match brick at vertical joints.
3. Joint-Sealant Color, Horizontal Joints: Match mortar at horizontal joints.

D. Exterior movement joints in stone masonry.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790, 756, or 795.
   b. For stain-sensitive stone such as marble, use DOW CORNING® 756.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E. Exterior joints within exterior insulation finish systems (EIFS).

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F. Exterior exposed joints in metal panel cladding systems.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 756.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Exterior concealed watertight joints in cladding systems.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 791.

H. Exterior joints between different materials listed above.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790, 756, or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
3. Multiple colors required to match several conditions.

I. Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790, 756, or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
3. Multiple colors required to match several conditions.

J. Exterior joints within aluminum storefront framing, curtain walls, and window systems:

1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant.
   a. DOW CORNING® 790, 756, or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

K. Exterior joints within structural glazing: As recommended by glazing manufacturer.

L. All other exterior non-traffic joints.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 790.

M. Exterior horizontal traffic and traffic isolation joints:

1. Joint Sealant: Single-component pourable silicone sealant.
   a. DOW CORNING® 790.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

**3.08 INTERIOR JOINT-SEALANT SCHEDULE**

A. Interior movement joints in exterior concrete and unit masonry.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 790 or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range].

B. Interior perimeter joints of exterior frames.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 791.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Interior movement joints in interior unit masonry.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 795.
2. Joint-Sealant Color: [As selected by Architect from manufacturer's full range] [Custom match wall color] [Multiple colors required].

D. Interior perimeter joints of interior frames.

1. Joint Sealant: Single-component neutral-curing silicone sealant.
   a. DOW CORNING® 791.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E. Interior sanitary joints between plumbing fixtures and food preparation fixtures and casework and adjacent walls, floors, and counters.

1. Joint Sealant: Mildew-Resistant, Single-Component, nonsag, acid-curing silicone joint sealant.
   a. DOW CORNING® 786.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range to match multiple conditions.

F. Interior traffic joints in floor and between floor and wall construction.

1. Joint Sealant: Single-component, nonsag, neutral-curing silicone joint sealant.
   a. DOW CORNING® 790
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Interior non-moving joints between interior painted surfaces and adjacent materials.

1. Joint Sealant: Siliconized acrylic latex.
2. Joint-Sealant Color: White; paintable.

H. Interior concealed sealants at thresholds and sills.

1. Joint Sealant: Butyl-rubber-based joint sealant.

I. Interior exposed and non-exposed acoustical applications:

1. Joint Sealant: Acoustical sealant as recommended by manufacturer.

**END OF SECTION**

# SECTION 08110

# HOLLOW METAL FRAMES

## PART 1 – GENERAL

### 1.01 RELATED DOCUMENTS

A. Refer to drawings for sizes.

### 1.02 SUMMARY

A. Section Includes:

1. Welded hollow metal door frames.
2. Factory finishing.

### 1.03 SUBMITTALS

A. Product Data: Submit manufacturer's product data for specified products and fabrications.

B. Shop Drawings and Schedules: Provide frame schedule and detailed drawings of fabrication and assembly, including the following information:

1. Identification of each opening, cross-referenced to the construction documents using thesame opening designations and numbering indicated.
2. Dimensioned frame product elevations, sections and profiles. Provide dimensions for proper edge clearances of doors, including meeting stiles for pairs of doors going into metal frames.
3. Material thicknesses, anchors and fastening.
4. Locations of welded and interlocking joints and connections, including field splices.
5. Show construction, hardware preparation, reinforcement, moldings, stops, trims and accessories. Coordinate with the final approved door hardware schedule.
6. Explanation of abbreviations, symbols, and nomenclature contained in submittal.

### 1.04 QUALITY ASSURANCE

A. Door Frame Inspection: Contractor with Installer shall inspect each door frame, checking frame for squareness, alignment, twist, plumbness and anchor attachment before installation of wallboard to assure proper fit of doors with correct clearances and operation without modification to the door. Frames that are out of tolerance shall be reinstalled to requirements.

### 1.05 QUALIFICATIONS

A. Manufacturer: Member of National Association of Architectural Metal Manufacturers (NAAMM), that manufacturers in accordance with standards set by the Hollow Metal Manufacturers Association (HMMA) for fabrication methods and product quality.Identification of each opening, cross-referenced to the construction documents using thesame opening designations and numbering indicated.

1. Company specializing in manufacturing products specified in this Section with minimum five years' experience.

### 1.06 DELIVERY, STORAGE AND HANDLING

A. Package or crate materials to provide protection during transit and delivery.

B. Remove wraps or covers upon delivery at the building site and ensure that scratches or disfigurement caused by shipping or handling are promptly cleaned and touched up with a rust inhibitive primer.

C. Inspect hollow metal work on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

D. Comply with HMMA 840. Properly store on planks or dunnage in a dry location. Welded frame product shall be stored in a vertical position, spaced by blocking. Materials shall be covered to protect them from damage but in such a manner as to permit air circulation.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Steel Doors and Frames:
1. Ceco Door Products: www.cecodoor.com.
2. Substitutions: See Section 01600 - Product Requirements.

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### 2.02 HOLLOW METAL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
   a. ANSI A250.8 Level 1 Doors: 16 gage frames.
   b. ANSI A250.8 Level 2 Doors: 14 gage frames.
   c. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage.
   d. Finish: Factory primed, for field finishing.
   e. Fabricate frames with mitered corners and seamless face joints.
   f. Fabricate frames full profile welded.
   g. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard

### 2.03 MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated steel sheet conforming to ASTM A 653 CS Type B, Coating Designation A40.

B. Frame Anchors, Internal Door Components and Reinforcements: Zinc-coated steel sheet conforming to ASTM A 653 CS Type B, Coating Designation A40.

C. Inserts, Bolts, and Fasteners: ASTM A 153 hot-dip galvanized.

D. Power-Actuated Fasteners: Corrosion resistant fasteners of size and configuration for applicable attachment configurations and substrates.

**2.04 FABRICATION**

A. General: Comply with NAAMM's HMMA 800 through 850 Series documents, unless more stringent requirements are specified. Fabricate hollow metal work to be neat and uniform in appearance and free from warpage or buckle. Edge bends shall be true and straight and of minimum radius for the thickness of metal used. Assemble units at the manufacturer's facility to the maximum extent possible.

1. Before shipment, mark each frame with an identification number as shown on approved submittal drawings and door schedule.
2. Tolerances and Clearances: Comply with HMMA 840.

B. Hollow Metal Frames:

1. Construction:

a. Frame product shall have integral stops of sizes and types shown on approved shop drawings.

b. Jamb, header, mullion and sill profiles shall be in accordance with the frame schedule and as shown on the approved submittal drawings.

c. Corner joints shall have all contact edges closed tight with faces mitered and stops butted.

d. Minimum height of stops shall be 5/8-inch.

e. Frames shall be prepared for single stud, resilient door silencers, three per strike jamb for single door openings, two per head for pairs, except on gasketed or weather stripped frame product. Silencers shall be supplied and installed by others.

f. Welding:

1) Perimeter face joints (flush or indented) shall be continuously welded internally or externally. Flush face joints shall be finished smooth with seamless faces. Rabbets and soffits shall be continuously welded internally.

2) Internal flush face joints shall be continuously welded and finished smooth with seamless faces.

3) Members at internal indented intersections shall be securely welded to concealed reinforcements, and have hairline face seams.

4) All other intersection elements shall have hairline seams.

5) Provide welded frames with temporary steel spreader bar welded to the feet of the jambs or mullions to serve as bracing during shipping and handling only. Spreader bars to be removed before installation.

g. Hardware Reinforcements and Preparations:

1) Frames shall be mortised, reinforced, drilled and tapped at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier. Where surface mounted non-templated hardware apply, frames shall be reinforced, with drilling and tapping done by others in the field.

2) Minimum steel thickness for hardware reinforcements shall be as follows:

i. Full Mortise Hinges and Pivots: 0.184 inch.

ii. Strikes, Pivots, Concealed Holders, or Surface Mounted Closers: 0.093 inch.

iii. Overhead Stops: 0.093 inch.

2. Floor Anchors: Provide floor anchors for frames, unless indicated otherwise. Floor anchors are in addition to jamb anchors.

a. Formed from same material and thickness as frames, but not less than 0.053 inch thick.

b. Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide two holes for fastening to substrate.

3. Jamb Anchors: Frames shall be provided with anchorage appropriate to frame and wall construction. Anchor requirements below are in addition to floor anchors.

a. Stud Wall Anchors: Combination anchor, not less than 0.053 inch thickness. Jamb anchors shall be placed at a maximum of 18 inches from top and bottom of openings. The minimum number of anchors spaced at maximum 32 inches on center, provided on each jamb, based on the over-all frame height, shall be as follows:

i. Up to 86 inches: 3 jamb anchors and one floor anchor.

ii. Greater than 86 inches, up to 96 inches: 4 jamb anchors and one floor anchor.

iii. Greater than 96 inches: 5 jamb anchors plus one for each 24 inches or fraction thereof, spaced at 32 inches maximum between anchors and one floor anchor.

b. Glazing Moldings and Stops:

i. Provide with steel moldings to secure glazing materials, in accordance with glazing sizes and thickness shown in the contract documents.

ii. Removable glass stops shall be channel shaped, not less than 0.032 inch thickness, with tight fitting butt or mitered corners, and secured with #6 minimum, corrosion resistant countersunk sheet metal screws.

iii. Metal surfaces to which glazing stops are applied, and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation of the stop.

iv. Glazing stops to have same zinc-coating and primer finish as the frames.

v. Fire rated frames shall be prepared for listed glazing as required in accordance with the manufacturer’s fire rating procedure.

vi. Fasteners: Zinc coated phillips head self-tapping screws. Fasteners located on secure side of opening

**2.05 FINISH**

A. Preparation: After fabrication, fill and sand all tool marks and surface imperfections as required to make surfaces free from irregularities and dressed smooth.
    1. Galvanannealed surfaces shall be wiped clean, removing dirt, oils and metal filings.
    2. Galvanized surfaces shall be cleaned and etched in accordance with primer manufacturer requirements.
    3. At exterior hollow metal work, repair galvanized surfaces with zinc-rich primer.

B. Primer: Rust inhibitive alkyd primer that permits latex and alkyd architectural coatings and two-component epoxies, aliphatic urethanes and oleo resinous industrial coating systems.

C. Prime coat external surfaces including faces, and vertical, top and bottom edges. Prime coat concealed glazed opening surfaces and glazing stops.

D. Fully cure primer before shipment.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that substrate conditions, whether existing or installed under other Sections, are as detailed in the construction drawings, and are acceptable for product installation in accordance with the manufacturer's instructions.

B. Check the area of floor on which the frame is to be installed, and within the path of door swing, for flatness and levelness.

C. Check slabs for location and depth of conduits and piping to ensure clearance from poweractuated fasteners and post installation fasteners.

**3.02 PREPARATION**

A. Check doors and frame for correct size, swing, fire-rating, and opening number. Verify adequate floor clearance above finish flooring scheduled for the door location, providing not less than 1/4 inch floor clearance from finish floor.

B. Remove temporary steel spreader bars before installation. Dress smooth area of removal by grinding and filling, removing tool marks and surface imperfections.

**3.03 INSTALLATION**

A. Hollow Metal Frames:

1. Set frames in proper location, temporarily braced, shimmed and held in position until permanently anchored.

    a. Properly space frame using wood template not less than 1 inch thick, that is nearly full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Provide additional spreader at mid height to correct or prevent bowing of frames and secure to maintain proper opening and clearance tolerances. Remove temporary braces necessary for installation after frames have been properly set and secured.

    b. Where frames are fabricated and shipped in sections, field splice at approved locations by welding face joint continuously or mechanical splice with recessed screws and filled. Dress smooth by grinding and filling, removing tool marks and surface imperfections.

    c. Floor Anchors: Provide for each jamb and mullion, and secure to substrate with not less than two power-actuated fasteners or post installation screw fasteners per anchor.

    d. Installation Tolerances: During the setting and securing of frames check and

correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Installation tolerances shall be maintained within the following limits.

i. Opening Width: Measured from rabbet to rabbet at top, middle and bottom of frame; plus 1/16 inch, minus 1/32 inch.

ii. Opening Height: Measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extensions at each jamb and across the head; plus 1/16 inch, minus 1/32 inch.

iii. Squareness: Measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 1/16 inch.

iv. Alignment: Measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 1/16 inch.

v. Twist: Measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 1/16 inch.

vi. Plumbness: Measured at the jambs on a perpendicular line from the head to the floor; not to exceed 1/16 inch.

B. Glazing Moldings and Stops:

1. Coordinate installation with Division 08 Section - Glazing and with hollow metal manufacturer's instructions. Screw attach with stops with uniformly spaced countersunk flathead or oval head fasteners to hold stops in position tight to opening without gaps or displacement.

**3.04 CLEANING**

A. Clean surfaces made dirty by field work.

B. Primer Touchup: Surfaces damaged from storage, handling and installation operations shall be sanded smooth and touch up with compatible rust inhibitive primer.

**END OF SECTION**

# SECTION 08211

# FLUSH WOOD DOORS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; non-rated.

B. 20 minute fire-rated doors.

### 1.02 REFERENCES AND REGULATORY REQUIREMENTS

A. NFPA 252 - Standard Methods for Fire Assemblies.

B. NFPA 80 - Fire Doors and Windows.

C. UL 10 B - Fire Tests for Door Assemblies - Neutral Pressure.

D. UL 10 C - Fire Tests for Door Assemblies - Positive Pressure.

E. WDMA Industry Standard (Window and Door Manufacturers Association).

F. AWS Quality Standards Edition 1.

G. 2012 IBC

H. 2012 Arkansas Fire Prevention Codes

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.

D. Manufacturer's Installation Instructions: Indicate special installation instructions.

### 1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Meet or exceed WDMA I.S.1-A Premium Grade.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

### 1.06 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

### 1.07 WARRANTY

A. See Section 01780 - Closeout Submittals for additional warranty requirements.

B. Provide warranty for the following term:
   1. Interior Doors: Life of installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Eggers Industries: www.eggersindustries.com.
   2. Haley Brothers: www.haleybros.com.
   3. Substitutions: See Section 01600 - Product Requirements.

### 2.02 DOORS

A. All Interior Doors: See drawings for locations and additional requirements.
   1. Quality Level: Premium Grade, Heavy Duty performance, in accordance with WDMA I.S.1-A.

### 2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

### 2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: Birch, premium grade wood veneer, plain-sliced, slip veneer match, running assembly match; unless otherwise indicated.

B. Facing Adhesive: Type I - waterproof.

### 2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

### 2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
   1. Transparent:
      a. System - 10, UV Curable, Water-based.
      b. Stain: As selected by Architect.
      c. Sheen: Semigloss.

B. Factory finish doors in accordance with specified quality standard:
   1. Finish to be selected by Owner from manufacturer's selection.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).

D. Use machine tools to cut or drill for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

### 3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

### 3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

**END OF SECTION**

# SECTION 08332

# WOOD OVERHEAD COILING DOORS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Wood overhead coiling doors

### 1.02 REFERENCES

A. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.

### 1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Door mounting: Outside mount, with coil mounted on face of wall, and guide rails mounted on face of wall at jambs.
   2. Door operation: Manual push-up.

### 1.04 SUBMITTALS

A. Submittals for Review:

   1. Shop Drawings: Indicate opening sizes, jamb, sill, and head conditions, and crank locations.

   2. Product Data: Manufacturer's descriptive literature for door units and hardware
   3. Samples:
      a. Color chips illustrating manufacturer's full range of available colors and finishes.
      b. After color selection submit minimum 8 inch long curtain slats showing species, grain, and finish.

B. Closeout Submittals:
   1. Operation and Maintenance Data.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Primary products supplied by single manufacturer with minimum 5 years documented experienced in fabrication of coiling wood doors.

B. Installer Qualifications: Minimum 2 years documented experience in work of this Section.

### 1.06 DELIVERY, STORAGE AND HANDLING

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

B. Store products in manufacturer's unopened packaging until ready for installation.

### 1.07 PROJECT CONDITIONS

A. Maintain temperature and humidity within manufacturer's recommended limits.

B. Do not install products under environmental conditions outside manufacturer's limits.

### 1.08 WARRANTIES

A. Provide manufacturer's standard limited warranty against manufacturing defects.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Contract Documents are based on products by Woodfold Mfg., Inc. (www.woodfold.com)

B. Substitutions: Under provisions of Division 01.

### 2.02 COMPONENTS

A. Curtain:
1. Slats: Solid hardwood profiles with long edges rabbeted to interlock to form sight-proof curtain.
2. Bottom rail: Solid wood profile matching grain and species of slat.
3. Wood species: Oak.
4. Interlocking hardware: Manufacturer's standard, concealed within slat and bottom rail profile.

B. Guides: Manufacturer's standard guides for indicated counter door mounting and operation.

C. Operator: Geared lifting and lowering mechanism with manual crank operator.

D. Guide Spacers: Manufacturer's standard spacers to provide clearance for gear box.

E. Latching Hardware:
1. Manufacturer's standard sidebolt surface mounted to curtain bottom rail at each end of curtain.

F. Hood: Plywood with veneer on sight-exposed face matching species of curtain material, or solid wood of same species as curtain material; concealed fastener construction to facilitate hood removal for servicing counter door.

G. Fascia: Plywood veneer on sight-exposed face matching species of curtain materials; concealed fastener attachment to facilitate fascia removal for servicing counter door.

### 2.03 FINISHES

A. Factory finish doors after fabrication.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install door assembly in accordance with manufacturer's instructions.

B. Anchor to adjacent construction without distortion or stress.

C. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.

D. Make connections between power supply, operator, and controls if applicable.

### 3.02 ADJUSTING

A. Adjust doors for smooth operation throughout full operating range.

**END OF SECTION**

# SECTION 08411

# ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 GENERAL

### 1.01 SUMMARY

A. Section Includes Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

B. Types of Kawneer Aluminum Storefront Systems include: Trifab™ VG 451T Framing System – 2" x 4-1/2" nominal dimension; Thermal; Center, Structural Silicone..

### 1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. Storefront System Performance Requirements:

1. See drawings for wind loading requirements.

2. Air Leakage: The test specimen shall be tested in accordance with ASTM E 283. Air Leakage rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.2 psf (300 Pa) with interior seal, or, rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 1.6 psf (75 Pa) without interior seal. CSA A440 Fixed Rating.

3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.

4. Uniform Load: A static air design load of 35 psf (1680 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

5. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.

6. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

   a. Temperature Change (Range): 0 deg F (-18 deg C); 180 deg F (82 deg C).

   b. Test Interior Ambient-Air Temperature: [75 deg F (24 deg C)] .

   c. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.

7. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:
   a. Glass to Exterior – 0.47 (low-e) or 0.61 (clear) or Project Specific (____) BTU/hr/ft2/°F.
   b. Glass to Center – 0.44 (low-e) or 0.61 (clear).
   c. Glass to Interior – 0.41 (low-e) or 0.56 (clear).

8. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
   a. Glass to Exterior – $70_{frame}$ and $69_{glass}$ (low-e) or $69_{frame}$ and $58_{glass}$ (clear).
   b. Glass to Center – $62_{frame}$ and $68_{glass}$ (low-e) or $63_{frame}$ and $56_{glass}$ (clear).
   c. Glass to Interior – $56_{frame}$ and $67_{glass}$ (low-e) or $54_{frame}$ and $58_{glass}$ (clear).

9. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
   a. Glass to Exterior – 38 (STC) and 31 (OITC).
   b. Glass to Center – 37 (STC) and 30 (OITC).
   c. Glass to Interior – 38 (STC) and 30 (OITC).
10. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
   a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
   b. Small-Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.

## 1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

## 1.04 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   a. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Structural-Sealant Glazing: Comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

F. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

**1.05 PROJECT CONDITIONS**

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

**1.06 DELIVERY, STORAGE, AND HANDLING**

1. Packing, Shipping, Handling, and Unloading
   a. Materials will be packed, loaded, shipped, unloaded, stored and protected in accordance with AAMA CW-10.

**1.07 WARRANTY**

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   a. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. Basis-of-Design Product:
   a. Kawneer Company Inc.
   b. Trifab™ 451T (Thermal) Framing System
   c. System Dimensions: 2" x 4-1/2" (50.8 mm x 114.3 mm)
   d. Glass: Center

B. Substitutions: See Section 01600 - Product Requirements.

**2.02 MATERIALS**

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

**2.03 STOREFRONT FRAMING SYSTEM**

A. Thermal Barrier (Trifab™ VG 451T):
   a. Kawneer IsoLock™ Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
      a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

**2.04 GLAZING SYSTEMS**

A. Glazing: As specified in Division 08 Section “Glazing”.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   a. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Color: Black
   b. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
      a. Color: Matching structural sealant.

**2.05 ENTRANCE DOORS**

A. As specified in Section 08413 – Aluminum Doors.

**2.06 FABRICATION**

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   a. Profiles that are sharp, straight, and free of defects or deformations.
   b. Accurately fit joints; make joints flush, hairline and weatherproof.
   c. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   d. Physical and thermal isolation of glazing from framing members.
   e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   f. Provisions for field replacement of glazing.
   g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

**2.07 ALUMINUM FINISHES**

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   a. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color to be selected from No.s 14, 17, 18, 26, 28, or 40).

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.
   a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   d. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

**3.03 FIELD QUALITY CONTROL**

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   a. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503,

including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.

a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 $cfm/ft^2$, whichever is greater.
b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

### 3.04 ADJUSTING, CLEANING AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

**END OF SECTION**

# SECTION 08413

# ALUMINUM DOORS

## PART 1 GENERAL

### 1.01 SUMMARY

A. Section Includes thermally broken entrance door.

a. AA™425 Thermal Entrance; Wide stile, 4-1/4" (108 mm) vertical face dimension, 2-1/4" (57 mm) depth, high traffic applications.

### 1.02 SYSTEM PERFORMANCE REQUIREMENTS

A. Aluminum door system performance requirements:

a. See drawings for wind loading requirements.

b. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 1.57 psf (75 Pa) for pairs of doors. A single 3'0" x 7'0" (915 mm x 2134 mm) entrance door and frame shall not exceed 1.0 cfm/ft2. A pair of 6'0" x 7'0" (1830 mm x 2134 mm) entrance doors and frame shall not exceed 1.0 cfm per square foot.

c. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 for typical application or L/180 for Small-Missile and Large-Missile impact, of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

d. To meet UFC 04-010-01, B-3.3 Standard 12 for exterior doors and Standard 10 for glazing.

e. Forced Entry: Tested in accordance with AAMA 1304.

f. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:

1) Insulated Glass – 0.43 (low-e) or as required by the energy code (most restrictive value).

g. Solar Heat Gain Coefficient: Glazed thermally broken aluminum door and frame shall have a solar heat gain coefficient as determined according to NFRC 200 or per local code requirements.

h. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:

1) Insulated Glass – 57frame and 71glass (low-e).

i. Condensation Resistance (I): When tested to CSA A440, the condensation resistance factor shall not be less than:

1) Insulated Glass – 48frame and 69glass (low-e).

j. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested in accordance with ASTM E 90, the STC and OITC ratings shall not be less than:

1) 32 (STC) and 28 (OITC).

**1.03 SUBMITTALS**

A. Product Data: Include construction details, material descriptions, and fabrication methods, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed entrance door indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum-framed door and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed entrance doors.

F. Fabrication Sample: Corner sample consisting of a door stile and rail, of full-size components and showing details of the following:
   a. Joinery, including welds.
   b. Glazing.

G. Other Action Submittals:
   a. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

**1.04 QUALITY ASSURANCE**

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating thermally broken aluminum-framed entrance doors and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports and calculations.

C. Source Limitations: Obtain thermally broken aluminum-framed door through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed glass entrance doors and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   a. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

**1.05 PROJECT CONDITIONS**

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

### 1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   a. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Basis-of-Design Product:
   a. Kawneer Company Inc.
   b. AA™425 Thermal Entrance
      1) Vertical Stile: 4-1/4"
      2) Top Rail: 4-1/4"
      3) Bottom Rail: 6-1/2"
      4) Mid Panel As required for panic device.
   c. Major portions of the door members to be 0.125" (4) nominal in thickness and glazing molding to be 0.05" (1.3 mm) thick
   d. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
   e. Provide adjustable glass jacks to help center the glass in the door opening.

B. Substitutions: See Section 01600 - Product Requirements.

### 2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum-framed door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and door leaf members.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum-framed door members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Slide-In-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
   a. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

### 2.03 STOREFRONT FRAMING SYSTEM

A. As specified in Section 08411 – Aluminum-Framed Entrances and Storefronts.

### 2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing".

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

**2.05 HARDWARE**

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors.

B. Standard Hardware:
   a. Weatherstripping:
      1) Meeting stiles on pairs of doors shall be equipped with two lines of weather-stripping utilizing wool pile with polymeric fin.
      2) The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing and a wool pile with polymeric fin.
   b. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (Necessary to meet specified performance tests).
   c. Threshold: Extruded aluminum, thermally broken, with ribbed surface.
   d. Offset Pivots
   e. Push/Pull.
   f. Exit Device.
   g. Closer
   h. Security Lock/Dead Lock.
   i. Cylinder.
   j. Strike Keeper:

**2.06 FABRICATION**

A. Fabricate thermally broken aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate thermally broken aluminum-framed doors that are reglazable without dismantling perimeter framing.
   a. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1" (24 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
   b. Accurately fit and secure joints and corners. Make joints hairline in appearance.
   c. Prepare components with internal reinforcement for door hardware.
   d. Arrange fasteners and attachments to conceal from view.

C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufactures drawings and details.

**2.07 ALUMINUM FINISHES**

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   a. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color to be selected from No.s 14, 17, 18, 26, 28, or 40).

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
   a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   d. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing thermally broken aluminum-framed entrance doors, hardware, accessories, and other components.

B. Install thermally broken aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill threshold in bed of sealant, as indicated, for weather tight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

### 3.04 ADJUSTING, CLEANING AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum-framed door and storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

**END OF SECTION**

# SECTION 08550

# ALMINUM CLAD WOOD WINDOWS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Factory fabricated aluminum clad wood windows with fixed sash.

### 1.02 REFERENCES

A. American Society for Testing Materials (ASTM):

1. E283: Standard Test method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
2. E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Door by Uniform Static Air Pressure Difference
3. E547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential
4. E2190: Specification for Sealed Insulated Glass Units
5. C1036: Standard Specification for Flat Glass
6. E2068: Standard Test Method for Determination of Operating Force of Sliding Windows and Doors

B. American Architectural Manufacturer's Association/Window and Door Manufacturer's Association (AAMA/WDMA/CSA):

1. AAMA/WDMA/CSA 101/I.S.2/A440-08, Standard/Specification for windows, doors and skylights
2. AAMA/WDMA/CSA 101/I.S.2/A440-11, Standard/Specification for windows, doors and skylights

C. WDMA I.S.4: Industry Standard for Water Repellant Preservative Treatment for Millwork

D. Window and Door Manufacturer's Association (WDMA): 101/I.S.2 WDMA Hallmark Certification Program

E. Sealed Insulating Glass Manufacturer's Association/Insulating Glass Certification Council (SIGMA/IGCC)

F. American Architectural Manufacturer's Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

G. National Fenestration rating Council (NFRC):

1. 101: Procedure for Determining Fenestration Product thermal Properties
2. 200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Show component dimensions.

C. Shop Drawings: Indicate opening dimensions.

### 1.04 QUALITY ASSURANCE

A. Manufacturer and Installer: Company specializing in manufacturing windows with minimum

three years of documented experience.

### 1.04 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect factory finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

### 1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

### 1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Clear insulating glass with stainless steel spacers is warranted against seal failure caused by manufacturing defects and resulting in visible obstruction through the glass for twenty (20) years from the original date of purchase. Glass is warranted against stress cracks caused by manufacturing defects from ten (10) years from the original date of purchase.

D. Standard exterior cladding finish is warranted against manufacturing defects resulting in chalk, fade and loss of adhesion (peel) per the American Architectural Manufacturer's Association (AAMA) Specification 2605-11 Section 8.4 and 8.9 for twenty (20) years from the original date of purchase.

E. Factory applied interior finish is warranted to be free from finish defects for a period of five (5) years from the original date of purchase.

F. Hardware and other non-glass components are warranted to be free from manufacturing defects for ten (10) years from the original date of purchase.

G. Warranty: Include coverage for:
   1. Degradation of color finish.
   2. Delamination or separation of finish cladding from window member.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Pella: www.pella.com.
   2. Marvin Windows: www.marvin.com.
   3. Substitutions: See Section 01600 - Product Requirements.

### 2.02 WINDOW COMPONENTS

A. Fixed Windows (see drawings for shape): Wood frame and sash, factory fabricated and assembled.
   1. Performance Requirements:
      a. AAMA/NWWDA 101/I.S.2 R15 or most current standard.
      b. Air Tested to 1.57 psf.
      c. Water tested to 7.5 psf.
      d. Structural tested to 75 psf.
   2. Exterior Surfaces: Metal clad, anodized, color as selected.
   3. Configuration: As indicated on drawings.
   4. Factory glazed; dry glazing method.

**2.03 FRAME DESCRIPTION**

A. Fame Interior: Clear pine, clear preservative treated in accordance with WDMA NWWDA I.S.4 using treatment type suitable for transparent or opaque finish.

1. Kiln-dried to moisture content no greater than 12 percent at the time of fabrication.

2. Water repellant, preservative treated in accordance with ANSI/WDMA I.S.4.

B. Frame Exterior Metal Cladding: Frame exterior clad with 0.050” thick extruded aluminum.

C. Frame thickness: 1 11/32” (34mm) head jamb, 1 11/32” (34mm) composite side jamb.

D. Frame depth: Frame depth had an overall 5 21/32” jamb (144mm). 4 9/16” (116mm) jamb depth from the nailing fin plane to the interior face of the frame for new construction.

E. Frame bevel: 8 degree.

F. Sill: 1 7/16” (37mm)

**2.04 SASH DESCRIPTION**

A. Interior: Clear pine or finger-jointed core with clear pine veneer; optional clear Douglas fir or finger-jointed core with clear Douglas fir veneer; optional clear white oak or finger-jointed with clear oak veneer; clear cherry or finger-jointed core with cherry veneer; clear mahogany or finger-jointed core with clear mahogany veneer; clear vertical grain Douglas fir or finger-jointed with clear vertical grain Douglas fir veneer

1. Kiln-dried to moisture content no greater than twelve (12) percent at the time of fabrication.

2. Water repellant preservative treated with accordance with WDMA I.S.4.

B. Sash exterior clad with 0.050” (1.3mm) thick extruded aluminum.

C. Sash thickness: 1 9/16” (40mm) for operating and transom units, 2” (51mm) for picture units.

D. Operable sash tilt to interior for cleaning or removal.

E. Interior Sash Sticking

1. Standard is: Ovollo.

2. Optional Interior Square sticking

## 2.05 GLAZING

A. Select quality complying with ASTM C1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E2190.

B. Glazing method: Insulating glass

C. Glazing seal: Silicone bedding on interior, acrylic foam adhesive tape on exterior

D. Glass Type: Gray, Tempered with argon.

## 2.06 FINISH

A. Exterior: Aluminum clad. Fluoropolymer modified acrylic topcoat applied over primer. Meets AAMA 2605 requirements.

1. Clad color options: Selected from one of the following: Stone White, Bahama Brown, Bronze, Pebble Gray, Evergreen, Sierra White, Coconut Cream, French Vanilla, Cashmere, Desert Beige, Cumulus Gray, Cadet Gray, Ebony, Arctic White, Cascade Blue, Hampton Sage, Wineberry, Bright Silver (pearlescent), or Copper (pearlescent)

B. Interior Finish options:

1. Factory-applied water-borne urethane stain. Stain applied over a wood (stain) conditioner. A water-borne acrylic enamel clear coat applied in two separate coats, with light sanding between coats, applied over the stain. Color to selected by Architect.

## 2.07 WEATHER STRIP

A. Appropriate factory installed weatherstripping for fixed units.

## 2.08 ACCESSORIES AND TRIM

A. Provide as required for proper installation and with design intent.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

## 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sills.

### 3.03 ERECTION TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

### 3.04 CLEANING

A. Remove protective material from factory finished surfaces.

B. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

**END OF SECTION**

# SECTION 08710

# DOOR HARDWARE

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Door hardware.

B. Lock cylinders for doors for which hardware is specified in other sections.

C. Thresholds.

D. Weatherstripping, seals and door gaskets.

### 1.02 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

B. BHMA A156.18 - American National Standard for Materials and Finishes; Builders Hardware Manufacturers Association, Inc.; 2006 (ANSI/BHMA A156.18).

C. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.

D. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.

F. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2009.

G. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

### 1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts,.
   2. Submit manufacturer's parts lists and templates.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

E. Keys: Deliver with identifying tags to owner by security shipment direct from hardware supplier.

F. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in the owner’s name and registered with manufacturer.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with five years of experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

### 1.07 COORDINATION

A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.

### 1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

### 1.09 MAINTENANCE PRODUCTS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

## PART 2 PRODUCTS

### 2.01 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.

D. Finishes: All door hardware the same finish unless otherwise indicated.
   1. Primary Finish: Satin chrome plated over nickel on brass or bronze, 626 / US26D.
   2. Secondary Finish: Satin chrome plated over nickel on brass or bronze, 626 / US26D.
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
   3. Specialty Finish at Entry and Waiting Doors: Oil Rubbed Bronze, 10B / US10B.
   4. Finish Definitions: BHMA A156.18.
   5. Exceptions:
      a. Where base metal is specified to be different, provide finish that is an appearance equivalent according to BHMA A156.18.

### 2.02 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:
   1. Applicable provisions of Federal, State, and local codes.
   2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
   3. Applicable provisions of NFPA 101, Life Safety Code.
   4. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

### 2.03 KEYING

A. Door Locks: Coordinate keying requirements with Owner.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

### 3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item: As listed in Schedule, unless otherwise noted:
   1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
   2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

### 3.03 ADJUSTING

A. Adjust work under provisions of Section 01700.

B. Adjust hardware for smooth operation.

### 3.04 PROTECTION

A. Protect finished Work under provisions of Section 01700.

B. Do not permit adjacent work to damage hardware or finish.

### 3.05 SCHEDULE

A. Accessibility Compliance: All hardware, including thresholds and closers, shall meet current ANSI and Governing Accessibility Standards.

B. Provide all corresponding and compatible strike plates and miscellaneous hardware as required.

C. Acceptable Manufacturers:

| | | |
|---|---|---|
| 1. | Hager | H |
| 2. | Pemco | P |
| 3. | Rixson | R |
| 4. | Schlage | SC |
| 5. | Stanley | ST |
| 6. | Sargent | S |
| 7. | Rockwood | RO |
| 8. | Norton | N |
| 9. | National Guard | NG |
| 10. | LCN | LCN |
| 11. | McKinney | M |
| 12. | Yale | Y |

D. Abbreviations:

| | | |
|---|---|---|
| Alum | = | Clear / Mill Aluminum |
| DW | = | Door Width |
| DH | = | Door Height |
| DOW | = | Door Opening Width |
| DOH | = | Door Opening Height |
| TBD | = | To Be Determined |

E. Door Hardware:

1. Set 1: Door mark(s) 1, 9, 24, 30.

| | | | | | |
|---|---|---|---|---|---|
| a. | Y | 1 ea. | Key Cylinder (Rim 0r Moritse) | | 1109 02r 2153 |
| | | 1 ea. | Door Closer | UNI 3501 with cover | 626 |

- Provide concealed vertical rod mid-panel panic device each door.
- If mortise cylinder is required, cylinder provider to supply appropriate cam for door lock mechanism.
- Balance of hardware by aluminum door supplier.

2. Set 2: Door Mark(s) 22, 23 and 34.

| | | | | |
|---|---|---|---|---|
| a. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | Y | 1 ea. | Lockset | AU5305LN x US26D |
| c. | N | 1 ea. | Door Closer | 8501 x 689 |
| d. | H | 1 ea. | Kickplate | 190S 10" x 34" x US32D |
| e. | H | 1 ea. | Wall Stop | 236W x US32D |
| f. | H | 3 ea. | Silencer | 307D |

3. Set 3: Door Mark(s) 3, 8, 15, 32.

| | | | | |
|---|---|---|---|---|
| a. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | Y | 1 ea. | Lockset | AU5305LN x US26D |
| c. | H | 1 ea. | Wall Stop | 232W x US32D |
| d. | H | 3 ea. | Silencers | 307D |

4. Set 4: Door Mark(s) 10, 14, and 21.

| | | | | |
|---|---|---|---|---|
| a. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | Y | 1 ea. | Lockset | AU5307LN x US26D |
| c. | H | 1 ea. | Wall Stop | 232W x US32D |
| d. | H | 3 ea. | Silencers | 307D |

5. Set 5: Door Mark(s) 11.

| | | | | |
|---|---|---|---|---|
| e. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| a. | Y | 1 ea. | Privacy Lockset | AU5302LN x US26D |
| b. | H | 1 ea. | Wall Stop | 232W x US32D |
| c. | H | 3 ea. | Silencers | 307D |

6. Set 6: Door Mark(s) 25, 27, 28, 29 and 31.

| | | | | |
|---|---|---|---|---|
| a. | H | 6 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | Y | 1 ea | Lockset | AU5305LN x US26D |
| c. | H | 2 ea. | Flushbolts | 282D x US26D |
| d. | H | 2 ea. | Wall Stop | 236W x US32D |
| e. | H | 2 ea. | Silencer | 307D |

7. Set 7: Door Mark(s) 19.

| | | | | |
|---|---|---|---|---|
| a. | H | 6 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | H | 2 ea. | Pull Plate | 33E 4" x 16" x US32D |
| c. | H | 2 ea. | Push Plate | 30S 4" x 16" x US32D |
| d. | N | 2 ea. | Door Closer | 8501 x 689 |
| e. | H | 2 ea. | Kickplate | 190S 10" x 34" x US32D |
| f. | H | 2 ea. | Wall Stop | 236W x US32D |
| g. | H | 2 ea. | Silencer | 307D |

8. Set 8: Door Mark(s) 5 and 6.

| | | | | |
|---|---|---|---|---|
| a. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | H | 1 ea. | Pull Plate | 33E 4" x 16" x US32D |
| c. | H | 1 ea. | Push Plate | 30S 4" x 16" x US32D |
| d. | N | 1 ea. | Door Closer | 8501 x 689 |
| e. | H | 1 ea. | Kickplate | 190S 10" x 34" x US32D |
| f. | H | 1 ea. | Wall Stop | 236W x US32D |
| g. | H | 3 ea. | Silencer | 307D |

4. Set 4: Door Mark(s) 2, 16, 17, and 18.

| | | | | |
|---|---|---|---|---|
| a. | H | 3 ea. | Hinge | BB1279 4 ½" x 4 ½" US26D |
| b. | Y | 1 ea. | Lockset | AU5308LN x US26D |
| c. | H | 1 ea. | Wall Stop | 236W x US32D |
| d. | H | 3 ea. | Silencers | 307D |

**END OF SECTION**

# SECTION 09000

## FINISH SCHEDULE

**REFER TO ROOM FINISH SCHEDULE ON SHEET A-4.1 IN THE SET OF DRAWINGS FOR ROOM FINISHES.**

# SECTION 09260

# GYPSUM BOARD ASSEMBLIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Gypsum wallboard.

### 1.02 REFERENCE STANDARDS

A. ASTM C 36/C 36M - Standard Specification for Gypsum Wallboard; 2001.

B. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2009)e1.

C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009)e1.

D. ASTM C 630/C 630M - Standard Specification for Water-Resistant Gypsum Backing Board; 2000.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2008.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2009a.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).

J. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2010.

K. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on gypsum board and glass mat faced gypsum board.

### 1.04 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay).
   1. Manufacturer's Warranty:
      a. Five years against manufacturing defects.

### 1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum Five years of documented experience.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC.

B. CertainTeed CorporationNone: www.certainteed.com.

C. Substitutions: See Section 01600 - Product Requirements

**2.02 GYPSUM BOARD ASSEMBLIES**

A. Provide completed assemblies at interior and exterior walls complying with ASTM C 840, GA-216 and as indicated in the construction documents.

**2.03 BOARD MATERIALS**

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces, unless otherwise indicated.
   2. Thickness:
      a. Interior Wall Vertical Surfaces: 5/8 inch.
      b. Exterior Wall Vertical Surfaces: 5/8 inch

B. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch (13 mm).
   3. Edges: Tapered.

**2.04 ACCESSORIES**

A. Corner Beads: Galvanized steel.

B. Edge Trim: L bead, as defined in ASTM C 840.

C. Textured Finish Materials: Latex-based compound; plain.

D. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

E. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that project conditions are appropriate for work of this section to commence.

**3.02 BOARD INSTALLATION**

A. Comply with ASTM C 840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Installation on Metal Framing: Use screws for attachment of all gypsum board.

**3.03 INSTALLATION OF TRIM AND ACCESSORIES**

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

### 3.04 TEXTURE FINISH

A. Texture Required: Smooth.

### 3.05 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

**END OF SECTION**

# SECTION 09511

# SUSPENDED ACOUSTICAL CEILINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

### 1.02 REFERENCE STANDARDS

A. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2011.

E. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

### 1.04 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### 1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

### 1.06 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

### 1.07 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 1 percent of total acoustical unit area of each type of acoustical unit for the owner's use in maintenance of project.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Manufacturers: Refer to drawings and finish schedule for acceptable manufacturers.

B. Substitutions: See Section 01600 - Product Requirements

### 2.02 ACOUSTICAL UNITS

A. 24”x24”x3/4”

1. Manufacturer: Armstrong
2. Series: Cirrus Tegular 584
3. Color: To be selected.
4. Grid: 15/16” steel – color to be selected – submit color chart.

B. 24”x48”x3/4”

1. Manufacturer: Armstrong
2. Series: 1728
3. Color: White
4. Grid: 15/16” steel – white.

### 2.03 ACCESSORIES

A. Refer to drawings and finish schedule for other requirements.

B. Touch-up Paint: Type and color to match acoustical and grid units.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

### 3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636, ASTM E 580, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

### 3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Lay acoustical insulation above all suspended ceilings.

H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

I. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

**3.04 TOLERANCES**

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**

# SECTION 09670

# RESINOUS FLOORING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Resinous flooring and base.

### 1.02 RELATED REQUIREMENTS

A. Section 01616 - Volatile Organic Compound (VOC) Content Restrictions.

### 1.03 SYSTEM DESCRIPTION

A. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with flintshot quartz aggregate broadcast and urethane topcoat. B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

B. Manufacturer’s Material Safety Data Sheet (MSDS) for each product being used.

### 1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two 3 x 3 inch square samples of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

### 1.05 QUALITY ASSURANCE

A. The Manufacturer shall have a minimum of 10 years experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in all phases of surface preparation and application of the product specified.

C. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.

D. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping

1. All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

**1.07 FIELD CONDITIONS**

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with cementitious urethane material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured for 14 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests. Outside of these parameters manufacturer shall be consulted.
2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
3. Sealers and curing agents should not to be used.
4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. The Owner shall be responsible for the removal of foodstuffs from the work area.
2. Non-related personnel in the work area shall be kept to a minimum.

**1.08 WARRANTY**

A. Dur-A-Flex, Inc. warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the expiration date.
B. Dur-A-Flex, Inc. liability with respect to this warranty is strictly limited to the value of the material purchase.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. Dur-A-Flex, Inc, Poly-Crete MDB (self- leveling broadcast quartz), Urethane topcoat seamless flooring system.

1. System Materials:
   a. Topping: Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and aggregate.
   b. The aggregate shall be Dur-A-Flex, Inc. flintshot quartz aggregate.
   c. Topcoat: Dur-A-Flex, Inc. Poly-Crete Color-Fast resin, hardener and powder aggregate.

2. Patch Materials
   a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).
   b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Poly-Crete WR.

## 2.02 MANUFACTURER

A. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802

B. Manufacturer of Approved System shall be single source and made in the USA.

## 2.03 PRODUCT REQUIREMENTS

| | | |
|---|---|---|
| A. | Topping | Poly-Crete MD |
| 1. | Percent Reactive | 100 % |
| 2. | VOC | 0 g/L |
| 3. | Bond Strength to Concrete ASTM D 4541 | 400 psi, substrates fails |
| 4. | Compressive Strength, ASTM C 579 | 7,400 psi |
| 5. | Tensile Strength, ASTM D 638 | 1,800 psi |
| 6. | Impact Resistance @ 125 mils, MIL D-3134, | >160 inch lbs |
| 7. | No visible damage or deterioration | |
| B. | Topcoat | Poly-Crete Color-Fast |
| 1. | Percent Solids | 100% |
| 2. | VOC | 0 g/L |
| 3. | Compressive Strength, ASTM C 579 | 7,800 psi |
| 4. | Tensile Strength, ASTM D 638 | 4,200 psi |
| 5. | Flexural Strength, ASTM D 790 | 1,000 psi |
| 6. | Abrasion Resistance, ASTM D 4060<br>CS-17 wheel, 1,000gm load, 1,000 cycles | 30 mg loss |
| 7. | Impact Resistance, ASTM D 1709 | 160 in.lbs |
| 8. | Shore D Hardness, ASTM D 2240 | 65 |
| 9. | Gloss, ASTM D 523, $60^0$ | Semi-gloss appearance |

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

B. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive base.

D. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

E. Verify that concrete sub-floor surfaces are ready for flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by flooring materials manufacturer.

**3.02 PREPARATION**

A. General

1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
2. Moisture Testing: Perform tests recommended by manufacturer and as follows.

. a. Perform relative humidity test using is situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
   b. If the relative humidity exceeds 99% then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
   c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.

3. Mechanical surface preparation
   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
   b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
   c. Wherever a free edge will occur, including doorways, wall perimeters, expansion joints, columns, doorways, drains and equipment pads, a ¼ inch deep by 3/16 inch wide keyways shall be cut in.
   d. Cracks and joints (non-moving) greater than 1/4 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.
4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

**3.03 INSTALLATION - FLOORING**

A. General

1. The system shall be applied in three distinct steps as listed below:
   a. Substrate preparation
   b. Topping/overlay application with quartz aggregate broadcast.
   c. Topcoat application, with an anti-slip aggregate broadcast if required
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Topping

1. The topping shall be applied as a self-leveling system as specified. The topping shall be applied in one lift with a nominal thickness of 3/16 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using a pin rake, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a 15/16 inch spiked roller.
6. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 1 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

C. Topcoat

1. The topcoat shall be mixed and applied per manufacturer recommended procedure.
2. The topcoat shall be comprised of three components, a resin, hardener and filler as supplied by the manufacturer.
3. The topcoat will be applied at the rate of 100 sf per kit (1.1 gal).
4. Non-Skid if required is broadcast at the rate of 1 lb per 100 sf and back rolled into the coating.
5. The finish floor will have a nominal thickness of 1/4 inch.

## 3.04 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:
   a. Temperature
      1. Air, substrate temperatures, relative humidity, and, if applicable, dew point.
   b. Coverage Rates
      1. Rates for all layers shall be monitored by checking quantity of material used against the area covered.

## 3.05 CLEANING AND PROTECTION

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until cured.

**END OF SECTION**

# SECTION 09680

# CARPET

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Carpet, stretched-in, with cushion underlay.

B. Carpet tile.

C. Accessories.

### 1.02 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug Institute; 2002.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

### 1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum five years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum five years experience.

### 1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

C. Ventilate installation area during installation and for 72 hours after installation.

### 1.06 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Mohawk Industries: www.mohawkgroup.com

B. J & J Industries, Inc: www.jjindustries.com.

C. Bigelow Commercial.

D. Mannington Commercial

E. Substitutions: See Section 01600 - Product Requirements.

**2.02 CARPET – STRETCHED IN**

A. Provide commercial grade carpet equal to Mannington Centerfield IV – 20 oz – Ultrabec RE and as follows:

1. Construction: Tufted texture-twist loop.
2. Face Fiber: Type 6,6 Four Hole, Hollow Filament Nylon, with Permanent Stain and Bleach Protection, Static Control, and Soil Resistant Treatment, and a Fiber Modification Ratio of <1.5.
3. Pile Thickness: 0.102 inches.
4. Tufted Yarn Weight: 20 ounces per square yard.
5. Dye Method: Solution-dyed.
6. Gauge: 1/10.
7. Density: Average density = 7,058.
8. Primary backing: 100% synthetic.
9. Secondary Backing: UltraBac RE with Minimum 10% Recycled Content and Lifetime Warranty Standard.
10. Standard Size: 12’ width.
11. Warranty: Lifetime Limited Warranty, Covering Face Wear, Delamination, Tuft Bind, Unraveling, and Static Protection
12. Bleach Resistant Warranty: ColorSafe with 15 Year Limited Warranty Against Color Loss from Bleach Spills.
13. Stain resistant Warranty: XGUARD with 15 Year Limited Warranty against Staining

**2.03 CUSHION**

A. Cushion: Modified polyurethane:

**2.04 CARPET TILE**

A. Provide commercial grade carpet equal to Mannington Carthage Legacy – 26 oz – Infinity Modular and as follows:

1. Construction: Graphic Loop Pile.
2. Face Fiber: Type 6,6 Four Hole, Hollow Filament Nylon, with Permanent Stain and Bleach Protection, Static Control, and Soil Resistant Treatment, and a Fiber Modification Ratio of <1.5.
3. Pile Thickness: 0.102 inches.
4. Tufted Yarn Weight: 26 ounces per square yard.
5. Dye Method: Solution 63% / Yarn 37%
6. Gauge: 1/10.
7. Density: Average density = 9,176.
8. Primary backing: 100% synthetic.
9. Secondary Backing: Infinity Modular Reinforced Composite Closed Cell Polymer
10. Standard Size: 24” x 24” Modular tiles.
11. Warranty: Lifetime Limited Warranty, Covering Face Wear, Delamination, Tuft Bind, Unraveling, and Static Protection

12. Bleach Resistant Warranty: ColorSafe with 15 Year Limited Warranty Against Color Loss from Bleach Spills.

13. Stain resistant Warranty: XGUARD with 15 Year Limited Warranty against Staining

**2.05 ACCESSORIES – CARPET STRETCHED-IN**

A. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

B. Edge Strips: Aluminum, color as selected by Architect.

C. Seam Adhesive: Recommended by manufacturer.

D. Contact Adhesive: Compatible with carpet material; releasable type.

**2.06 ACCESSORIES – CARPET TILE**

A. Trowelable Leveling and Patching Compounds: Portland cement-based formulation provided by or recommended by carpet tile manufacturer. Do not use gypsum based compounds.

B. Adhesives: Water-resistant, mildew resistant, and non-staining, high solids, low VOC emitting formulations that are specifically recommended by the carpet manufacturer, as verified through compatibility and adhesion testing for the intended substrate and application, and that comply with flammability requirements for installed carpet.

C. Edging: Provide rubber composition carpet edging in single lengths wherever possible, keeping the number of joints or splices to a minimum. Provide in quantities and locations as job required based upon the recommended good practice of the industry; include in every location where carpet terminates and other flooring continues. Color to match adjacent carpet types and as selected by the Architect...

D. Floor Sealer: Type as recommended and manufactured by the carpet tile manufacturer for the applications indicated.

**PART 3 EXECUTION**

**3.01 PRE-INSTALLATION MEETING**

A. Prior to the installation, meet at the project site to review the material selections, substrate preparations, installation procedures, coordination with other trades, special details and conditions, standard of workmanship, and other pertinent topics related to the Work. The meeting shall include the Owner, the Architect of Record, the Contractor, the installer, material manufacturer's representatives, and representatives of other trades or subcontractors affected by the installation.

**3.01 EXAMINATION**

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.

C. Verify that required floor-mounted utilities are in correct location.

**3.02 PREPARATION**

A. Coordinate the installation of carpet so as not to delay the occupancy of the site or interfere with the completion of construction.

B. Examine the substrates, adjoining construction and the conditions under which the Work is to be installed. Verify recommended limits for moisture content and alkalinity of concrete substrates with carpet manufacturer.

1. Moisture Content: Verify moisture content using a standard calcium chloride crystal test

or a 1 square yard (0.84 sq.m) clear plastic test. Perform testing at a frequency as recommended by the carpet manufacturer. Perform testing at a frequency of not less than once every 1,000 square feet (93 sq.m).

2. Alkalinity Test: Verify alkalinity of concrete substrates by drilling a 3/8 inch (9.5 mm) diameter hole approximately 1/4 inch (6.35 mm) deep, remove all residue; fill with distilled water, allow water to stand 3 minutes and test with a calibrated electronic meter or Ph paper. Perform testing at a frequency of not less than once every 1,000 square feet (93 sq.m).

3. Alternative test procedures for moisture content and alkalinity may be acceptable subject to the carpet manufacturer's review and written acceptance.

C. Concrete Subfloors: Verify that concrete slabs comply with the following:

1. Remove coatings, including curing compounds, existing floor covering adhesive residues, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.

2. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the carpet manufacturer.

3. Use leveling and patching compounds recommended by flooring manufacturer for filling cracks, holes and depressions in the substrate. Surface shall be smooth, level and at proper elevation. Remove ridges, roughness and protrusions from concrete surfaces by grinding.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

E. Carpet installation shall not commence until painting and finishing work are complete and ceiling and overhead work is tested, approved, and completed.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.03 INSTALLATION - GENERAL**

A. Comply with the manufacturer's instructions, specified industry standards and recommendations, and as required to match the accepted sample installations. Apply adhesive in accordance with adhesive manufacturer's directions.

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Lay out carpet and locate seams in accordance with shop drawings:
1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
2. Do not locate seams perpendicular through door openings.
3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
4. Locate change of color or pattern between rooms under door centerline.
5. Provide monolithic color, pattern, and texture match within any one area.

D. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

**3.04 INSTALLATION STRETCHED-IN CARPET**

A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.

B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch (9 mm).

C. Install cushion in maximum size pieces using spot adhesive to adhere to sub-floor.

D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches (150 mm) from carpet seams.

E. Butt cushion edges together and tape seams.

F. Trim cushion tight to edge of tackless strip and around projections and contours.

G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.

H. Join seams by hand sewing. Form seams straight, not overlapped or peaked, and free of gaps.

I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.

J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.

**3.05 INSTALLATION CARPET TILE**

A. Comply with the manufacturer's instructions, specified industry standards and recommendations, and as required to match the accepted sample installations. Apply adhesive in accordance with adhesive manufacturer's directions.

B. Adhere all full size, perimeter tiles, and cut tiles, with a full spread of adhesive. Dry fit cut tiles and apply adhesive to tile back after tile has been cut. Use full uncut tiles down the center of corridors and, where necessary, cut perimeter tiles to butt walls.

1. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

2. Cut openings in carpet for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges of carpet will be covered by plates and escutcheons.

3. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Butt carpet tile tightly together to form seams without gaps or entrapped pile yarns and aligned with adjoining tiles.

D. Edge Strip Installation: Install edge strip at every location where edge of carpet is exposed to traffic, unless otherwise indicated. Unless otherwise directed by the Architect of Record, install in single lengths and secure in accordance with manufacturer's directions.

E. Traffic over adhesive installations shall be restricted until adhesive has properly cured in accordance with the adhesive manufacturers recommendations.

**3.06 CLEANING**

A. Cleaning: As the carpeting is installed, remove and dispose of all trimmings, excess pieces of carpeting and laying materials from each area as it is completed. Vacuum carpeting with a commercial vacuum, having a cylindrical brush or beater bar and high suction. Remove adhesives, stains, and soil spots in accordance with the carpet manufacturer's recommendations.

**3.07 PROTECTION**

A. Protection: Protect carpeting against damage of every kind as damaged carpeting shall be rejected. Use non-staining cover material for protection. Tape joints of protective covering.

1. Plastic and polyethylene sheet protective coverings shall not be permitted.

2. Remove and replace rejected carpeting with new carpeting. At the completion of the work, remove covering, vacuum clean carpeting and remove soiling and stains (if any) to the satisfaction of the Owner and the Architect.

**END OF SECTION**

# SECTION 09855

# ACOUSTICAL WALL PANELS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Shop-fabricated acoustical wall panels with fabric facings.

### 1.02 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of core and facing material, and mounting indicated.

C. Samples: For each type of core and facing material, and mounting indicated assembled in panels approximately 6 by 6 inches.

### 1.03 WARRANTY

A. Warranty Period: 5 years

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Acoustical Surfaces, Inc. / acousticalsurfaces.com

B. Substitutions: See Section 01600 - Product Requirements

### 2.02 ACOUSTICAL WALL PANELS

A. Panel Materials:
   1. Core Material: 6 to 7 lb. density glass fiber.
   2. Core Thickness: 2 inch.
   3. Sizes: Custom sizes as indicated on Drawings.
   4. Mounting: Concealed Splines.
   5. Edge Details: Half Bevel.
   6. Edge Treatments: Soft.
   7. Acoustical Properties for 6 to 7 pcf glass fiber:
      a. For 2 inch thickness: NRC of 1.15.
   8. Fire Resistance: This pattern meets the requirements of National Fire Protection Association (NFPA) Class A or 1.
      1) Flame Spread: 15.
      2) Smoke Developed: 40.

B. Fabric Facing Materials:
   1. Type: Guilford FR 701 2100 Fabric Facings.
   2. Style and Color: As selected by Architect from manufacturer’s standard selection.
   3. Fire Resistance: This pattern meets the requirements of National Fire Protection Association (NFPA) Class A or 1.
      a. Flame Spread: 5.
      b. Smoke Developed: 70.

C. Attachment Materials:
   1. Splines and associated components for complete installation.

### 2.03 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

### 3.02 INSTALLATION

A. General: Comply with decorative acoustical wall panel manufacturer's written instructions for installation and type of mounting specified.

### 3.03 CONCEALED SPLINES

A. Panels with concealed spline attachment are provided with kerfs along the edges of the panels. The spline then inserts into one panel and is mounted onto the wall. Adjoining panels are inserted into the remaining half of the spline.

**END OF SECTION**

# SECTION 09900

# PAINTS AND COATINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically so indicated.
6. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
7. Glass.
8. Concealed pipes, ducts, and conduits.

### 1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2011.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

### 1.03 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this section.

### 1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

### 1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation,

and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions. Protect from freezing.

### 1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

B. Paints:
   1. See room Finish Schedule on drawings.

### 2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each coating material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

C. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

D. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

### 2.03 PAINT SYSTEMS - INTERIOR

A. Paint - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of latex primer.
   2. Two coats of semi-gloss latex enamel.

3. Typical Areas.

B. Paint - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of high performance epoxy primer.
   2. Two coats of high performance semi-gloss epoxy.
   3. Kitchen and Service Areas.

C. Paint - Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer.
   2. Two coats of semi-gloss latex enamel.
   3. Typical Areas.

D. Paint - Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with high performance epoxy primer.
   2. Two coats of high performance semi-gloss epoxy.
   3. Kitchen / Break and Service Areas.

E. Gypsum Board, Latex, 3 Coat:
   1. One coat of latex primer sealer.
   2. Two coats of semi-gloss latex enamel.
   3. Typical public areas.

F. Gypsum Board, Latex, 3 Coat:
   1. One coat of high performance latex primer sealer.
   2. Two coats of high performance semi-gloss epoxy.
   3. Kitchen / Break and Service Areas.

### 2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

### 3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

H. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

I. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

J. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

**3.03 APPLICATION**

A. Apply products in accordance with manufacturer's instructions.

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 CLEANING**

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.05 OTHER REQUIREMENTS**

A. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted.
   2. Fire rating labels, equipment serial number and capacity labels.

B. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
   1. Paint all conduit and boxes occurring in finished areas to match background surfaces, unless otherwise indicated.
   2. Paint shop-primed items occurring in finished areas.
   3. Exposed Steel Lintels.

END OF SECTION

# SECTION 09930

# STAINING AND TRANSPARENT FINISHING

## PART 1 GENERAL

### 1.01 SUMMARY

A. Transparent wood finish systems for field application.

B. Additional product requirements, execution, and surfaces not to be finished are specified in Section 09900.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Base Manufacturer:
   1. Pratt & Lambert Paints: www.prattandlambert.com.
   2. Minwax:

### 2.02 INTERIOR TRANSPARENT FINISH SYSTEMS

A. On Interior Doors: Per manufacturer's recommendation for application. Provide color options for selection by Architect.

B. Interior Wood - Oil Stain with Clear Finish: For all interior wood items unless otherwise indicated
   1. Preparation as specified by manufacturer.
   2. Open-Grained Wood: Fill and stain simultaneously with filler mixture as specified by manufacturer, using Tonetic Oil Wood Stain.
   3. Close-Grained Wood: 1 coat Tonetic Oil Wood Stain.
   4. 1 coat Sanding Sealer recommended by manufacturer.

## PART 3 EXECUTION (SEE SECTION 09900)

**END OF SECTION**

# SECTION 10160

# POLYMER (HDPE) TOILET COMPARTMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Polymer (HDPE) Floor Anchored / Overhead-Braced Toilet Compartments.

B. Urinal screens.

### 1.02 DESCRIPTION

A. Plastic compartment work includes the following:

1. Floor anchored/overhead braced partitions

B. Furnish all labor and materials necessary for the completion of work in this section as shown on the contract drawings and specified herein.

C. Work in this section shall include, but is not limited to:

1. Toilet compartments.

2. Hardware for toilet compartments and plastic partitions.

3. Shop drawings and working drawings.

4. Manufacturer's guarantee.

D. Related work specified elsewhere shall include accessories and anchorage/blocking for attachment of compartments.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Global Partitions: www.globalpartitions.com

B. Substitutions: Section 01600 - Product Requirements.

### 2.02 MATERIALS

A. Doors, panels and pilasters to be 1" thick with homogeneous color throughout, constructed from high density polyethylene (HDPE) resins, which are, waterproof non-absorbent and have a self-lubricating surface that resists markings from pens, pencils and other writing instruments.

### 2.03 COMPONENTS

A. Toilet Compartments: Stainless steel, floor-mounted headrail-braced.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.

C. Door and Panel Dimensions:
1. Thickness: 1 inch.
2. Door Width: 30 inch.
3. Door Width for Accessible Use: 36 inch (915 mm).
4. Height: 55 inches.

D. Pilasters: 1 inch thick, of sizes required to suit compartment width and spacing.

E. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

### 2.04 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch (175 mm) high, concealing floor fastenings.

B. Head Rails: Hollow stainless steel tube, 1 x 1-5/8 inch (25 x 41 mm) size, with anti-grip strips and cast socket wall brackets.

C. Brackets: Polished stainless steel.

D. Hardware: Polished stainless steel:
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Thumb turn or sliding door latch with exterior emergency access feature.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one per compartment, mounted on door.
5. Provide door pull for outswinging doors.

### 2.05 FINISHING

A. Hammered with full color selection.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

### 3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

### 3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

### 3.04 WARRANTY

A. 15 year manufacturer warranty against breakage, corrosion and delamination.

**END OF SECTION**

# SECTION 10260

# WALL CORNER GUARDS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Polycarbonate Corner Guards.

### 1.02 SUBMITTALS

A. Product data for each type of Corner Guard specified.

B. Cleaning and maintenance instructions.

### 1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite and store in original packaging in a climate controlled location away from direct sunlight.

### 1.04 PROJECT CONDITIONS

A. Products must be installed in an interior climate controlled environment.

### 1.05 WARRANTY

A. Standard CAP Limited Lifetime Warranty against material and manufacturing defects.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. The Corner Guard Store / www.thecornerguardstore.com
B. Substitutions: Section 01600 - Product Requirements.

### 2.02 PRODUCT

A. Polycarbonate corner guards with the following characteristics:

1. Size: 48” x .75” x .75”

2. Surface mounted 90 degree guards.

### 2.03 FINISH

A. Clear.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Examine areas and conditions in which the corner guard systems will be installed.

B. Complete all finishing operations, including painting, before beginning installation of corner guards.

C. Wall surface shall be dry and free from dirt, grease and loose paint.

### 3.02 INSTALLATION

A. Surface must be dry, clean and properly sealed.

B. Attachment as recommended by manufacturer for application.

### 3.03 CLEANING

A. As recommended by manufacturer.

**END OF SECTION**

# SECTION 10445

# DOOR AND ROOM SIGNS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Door Signs.

### 1.02 REFERENCES

A. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; US Architectural and Transportation Barriers Compliance Board; 2004.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for sign types specified, including components and accessories.

C. Shop Drawings: Indicate location of each individual sign in the project.

D. Selection Samples: Two sets of color chips representing manufacturer's full range of available colors.

E. Manufacturer's instructions: Printed installation instructions for each product.

### 1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Sign types to comply with 2010 ADA Standards for Accessible Design.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products of this section in manufacturer's unopened packaging until installation.

B. Maintain dry, heated storage area for products of this section until installation of products.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. mydoorsign.com

B. plaquemaker.com

C. Substitutions: See Section 01600 - Product Requirements.

### 2.02 MANUFACTURED UNITS

A. Accessibility Signs:
   1. Manufacturer: mydoorsign.com

   2. Colors: To be selected by manufacturer's standard colors. Lettering to contrast background color.

   3. Family Restroom – Door 11:
      a. Sign: SE-2297.
      b. Mounting: Sign holder – mount in accordance with accessibility standards.

   4. Women’s Restroom – Door 5:
      a. Sign: SE-2376.
      b. Mounting: Sign holder – mount in accordance with accessibility standards.

4. Men's Restroom – Door 6:
   a. Sign: SE-2373.
   b. Mounting: Sign holder – mount in accordance with accessibility standards.

5. Interior Occupant Load Posting at Multi-purpose Room: Door19:
   a. Sign: Custom engraved plastic sign.
   b. Size: 8" x 10".
   c. Thickness: 60 mil.
   d. Mounting: Sign holder – mount in accordance with accessibility standards.
   e. Text: "Maximum Occupant Load – 473".

B. Exterior Occupant Load Signs:
   1. Manufacturer: plaquemaker.com

   2. Finish: Stainless Steel. Lettering to contrast background color.

   3. Multi-purpose Room – Door(s) 24 and 30.
      a. Sign: Custom engraved outdoor stainless steel sign.
      b. Size: 8" x 10" with 1" black lettering.
      c. Thickness: 24 gauge.
      d. Mounting: Mount in accordance manufacturer's instructions for installation on masonry wall. No exposed fasteners through sign. Provide mounting frame.

C. Accessories: Installation accessories specified in manufacturer's instructions.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces to receive signs have been finished, and that finishes are dry and correctly cured.

### 3.02 INSTALLATION

A. Install room and door signs in accordance with manufacturer's printed installation instructions.

B. Locate signs in accordance with approved shop drawings and ADAAG / 2010 ADA Standards for Accessible Design.

**END OF SECTION**

# SECTION 10523

# FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

### 1.02 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

### 1.03 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

### 1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions and wall bracket mounted measurements.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

### 1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Substitutions: See Section 01600 - Product Requirements.

### 2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Provide fire extinguishers where located in cabinets or mounted on walls or columns designated as F.E. or F.E.C..

C. Dry Chemical Type Fire Extinguishers: Cast steel tank, with pressure gage.
   1. Class A:B:C.
   2. Size 10.
   3. Finish: Baked enamel, Red color.

**2.03 FIRE EXTINGUISHER CABINETS**

A. Provide fire extinguishers where located in cabinets or mounted on walls or columns designated as F.E. or F.E.C. or by key symbol.

B. Metal: Formed stainless steel sheet; 0.036 inch (0.9 mm) thick base metal.

C. Cabinet Configuration: Recessed type with trim skirt.
   1. Exterior nominal dimensions of 13 inch (330 mm) wide x 27-1/2 inch (700 mm) high x 6 inch (150 mm) deep.
   2. Trim: Returned to wall surface, with 2-1/2 inch (63.5 mm) projection, 13 inch (330 mm) wide face.
   3. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

D. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

E. Door Glazing: Plastic, clear, 1/8 inch (3 mm) thick acrylic. Set in resilient channel gasket glazing.

F. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

G. Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: No. 4.

I. Finish of Cabinet Interior: White enamel.

**2.04 ACCESSORIES**

A. Extinguisher Brackets: Formed steel, chrome-plated.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

**3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions and in compliance with accessibility standards..

B. Install cabinets plumb and level in wall openings, 36 inches (900 mm) from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. See floor plans for locations.

**END OF SECTION**

# SECTION 10800

# TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

B. Grab bars.

### 1.02 REFERENCE STANDARDS

A. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2010.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

C. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2003 (Reapproved 2009).

D. ASTM C1036 - Standard Specification for Flat Glass; 2006.

E. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

### 1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. See drawings for manufacturers specified.

B. Products listed are made by Bradley.

C. Other Acceptable Manufacturers:
   1. American Specialties, Inc: www.americanspecialties.com.
   2. Bobrick Washroom Equipment, Inc: www.bobrick.com.
   3. Substitutions: Section 01600 - Product Requirements.

D. All items of each type to be made by the same manufacturer.

### 2.02 FINISHES

A. As scheduled on drawings.

### 2.03 TOILET ROOM ACCESSORIES

A. Provide toilet accessories as scheduled on drawings.

B. Grab Bars: Stainless steel, 1-1/4 inches (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches (38 mm) clearance between wall and inside of grab bar.
   1. Length and configuration: As indicated on drawings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

### 3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

### 3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

**END OF SECTION**

# SECTION 11400

# FOOD SERVICE EQUIPMENT

## PART 1 GENERAL

## PART 2 PRODUCTS

### 2.01 EQUIPMENT

A. Scheduled Equipment: Refer to kitchen equipment schedule in the drawings for Owner and Contractor responsibilities.

B. Exhaust Hoods: Refer to mechanical documents for exhaust hood information. Exhaust hoods are to be installed by the general contractor.

C. Installation Accessories: Provide all rough-in hardware, supports and connections, attachment devices, closure trim, and accessories required for complete installation.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.

B. Verify that electric power is available and of the correct characteristics.

### 3.02 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Insulate to prevent electrolysis between dissimilar metals.

C. Provide sealant to achieve clean joint with adjacent building finishes and between abutting components.

### 3.03 ADJUSTING

A. Adjust equipment and apparatus to ensure proper working order and conditions.

B. Remove and replace equipment creating excessive noise or vibration.

### 3.04 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Wash and clean equipment.

C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

**END OF SECTION**

# SECTION 13010 – GENERAL PROVISIONS

## PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
   a. Fire Protection systems and equipment.

B. Related Sections:

1. DIVISION 15 - MECHANICAL.

2. DIVISION 16 - ELECTRICAL.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: The Fire Protection system shall conform to the standards of the Pocahontas, AR Area Seismic Zone.

1. Provide Seismic Restraints per the Arkansas Building Code and NFPA.

1.3 REFERENCE STANDARDS, CODES, FEES AND UTILITY CONNECTION CHARGES

A. Local codes.

B. Arkansas Building Code.

C. State Codes

D. FM - Factory Mutual.

E. Federal Codes.

F. IEEE - Institute of Electrical Electronic Engineers.

G. ANSI - American National Standards Institute.

H. ASME - American Society of Mechanical Engineers.

I. NEMA - National Electrical Manufacturer's Association.

J. NFPA - National Fire Protection Association.

K. UL - Underwriters Laboratories, Inc.

L. AMC - Arkansas Mechanical Code.

M. APC - Arkansas Plumbing Code.

N. OSHA - Occupational Safety and Health Act.

O. Standards Compliance: When materials or equipment must conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), and Underwriters Laboratories (UL), proof of such conformance shall be submitted for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified.

P. Contractor shall make arrangements with utility company(ies) for their services and metering work. Pay all charges therefore, and include the cost thereof in the contract price.

1.4 QUALITY ASSURANCE

A. Supply all equipment and accessories new and free from defects.

B. Products Criteria:
1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least two years prior to bid opening. Provide list of users upon request.
2. Equipment having less than a two year use record, which in the opinion of the Engineer, provides significant benefits to the Owner such as improved energy efficiency, will be acceptable if it is a product of a manufacturer who has been regularly engaged in the manufacture of that specific type of product which has been used in similar applications for a period of two years. The Architect/Engineer reserves the right to require the Contractor to submit evidence to this effect for his approval.
3. Equipment Service: Products shall be supported by a service organization which maintains an adequate inventory of repair parts and is located, in the opinion of the Architect/Engineer, reasonably close to the site.
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

C. Equipment Vibration Tolerance:
1. After air and/or water balance work is completed and permanent drive mechanisms are in place, perform field mechanical balancing and adjustments required to meet specified vibration tolerance.

D. Welding: Before any welding is performed submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.

1. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed in accordance with appropriate construction code, to each completed weld.
2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ANSII/ASME B31.1.

E. Supply all equipment and accessories in comp lance with the applications listed in Article 1.3 of this section and with all applicable national, state, and local codes.

F. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished for record to the Architect/Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations may be cause for rejection of the material.

G. When included, reflected ceiling plan drawings shall govern over mechanical and electrical drawings for location of ceiling-installed elements.

H. In addition to all requirements specified hereinafter, each material and equipment item shall have all features as standard with its manufacturer and/or required for the complete operational system.

I. Capacities, ratings, sizes, and other requirements not specified hereinafter shall be as scheduled or otherwise indicated on the drawings.

J. Should the Contractor at any time discover a discrepancy in the drawings or with respect to a variance of code requirements, he shall notify the Architect/Engineer for clarification and shall not proceed with the work affected until clarification has been made.

## 1.5 SUBMITTALS

A. Submittals and shop drawings shall be submitted in accordance with these CONTRACT DOCUMENTS and in accordance with the following:
1. Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication, or delivery of the items to the job site. Partial submittals will not be acceptable and will be returned without review. All equipment, material, and manufacturer's literature shall be submitted for approval at one time and in a tabulated binder. Control drawings and the controls equipment submittal may be submitted at a later time, but as soon as practical after the contract has been awarded and after the general equipment submittal has been made. However, every attempt shall be made to include the complete controls submittal with the general equipment submittal at one time.
2. The submittal shall include summary cover sheet(s) and manufacturer's literature under each tab of the submittal binder which together clearly indicate compliance or deviation from the specifications and drawings.
3. Submission material and all shop drawings shall be marked with the appropriate identification relating the equipment to the drawings. Mark and reference each item on the submittal summary sheet and the manufacturer's literature to the appropriate

paragraph number in the specifications. Manufacturer's standard catalogs will not be accepted.

4. Failure to comply with the above for a complete and clear submittal may result in resubmittal.

B. Operating instructions and parts lists.
   1. Before requesting acceptance of work, furnish the number of printed and hardback bound sets required.
   2. Equipment and systems.
      a. Complete description of equipment and systems and basic operating features.
      b. Manufacturer's name, model number, service manual, spare parts list, and descriptive literature for all components.
   3. Maintenance instructions.
   4. Listing of possible breakdown and repairs.
   5. Instruction for starting and operation.
   6. Detailed and simplified one line, color coded flow and wiring diagrams.
   7. Schedule of valve identification.

1.6 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.
   1. Report in writing, conditions which will prevent proper provision of this work.
   2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without prior approval, shall be altered by contractor, without cost to Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies which may be discovered or anticipated shall be reported promptly. Architect/Engineer shall have privilege of making minor changes without additional cost, provided that such changes are made before commencing work on items involved.

B. Continuity of Services and Connections to Existing Work:
   1. At no additional cost to Owner, provide all necessary temporary connections and temporary facilities to accomplish the required continuity of services and existing operations.
   2. Arrange all work to interfere as little as possible with the normal existing operations. Do not interrupt any existing utility or other service or existing operation at any time without Owner's prior approval. After each interruption has been made, make all necessary connections and alterations, and restore services and avoid interferences with normal existing operations as quickly as possible.
   3. Install new work and connect to existing work with minimum interference to existing facilities and maintain water and air tightness when applicable.
   4. Temporary shutdowns of existing services:
      a. At no additional charges.
      b. At times not to interfere with normal operation of existing facilities.
      c. Only with written consent of Owner.
   5. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
   6. Connect new work to existing work in neat and satisfactory high quality workmanship manner.
   7. Restore existing disturbed work to original or better conditions.

1.7 ACCURACY OF DATA AND DRAWINGS

A. Drawings are generally diagrammatic, and where not dimensioned or detailed, indicated approximate locations of work. Examine carefully existing buildings and structures, existing systems, and all other contract drawings, and install work to conform as nearly as possible to locations and arrangements indicated, with only such minor adjustments as necessary to coordinate mechanical work with other work, and to avoid interferences therewith. All piping and ductwork, offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

B. Building and structure dimensions: TAKE THESE FROM ARCHITECTURAL AND FROM ACTUAL MEASUREMENTS OF EACH EXISTING BUILDING AND EACH EXISTING STRUCTURE INVOLVED.

1.8 COORDINATION

A. Carefully examine the architectural, electrical, heating and air-conditioning, plumbing, fire protection, structural, and site plan drawings and specifications, and coordinate this work among trades to avoid delay.

B. Permanent openings or knockout panels are provided to permit only future service or replacement of system components, not the entire assembly. The Contractor shall coordinate his equipment delivery with construction progress so that installation may be made in an orderly manner.

C. The structural design is based on installed locations of the equipment only. Any necessary shoring or other protection necessary for moving heavy equipment to installed location is the responsibility of the Contractor. Take extra precautions in using any existing structure for hoisting or temporary support.

D. Wherever piping, conduits, ducts, or other items are to run in the same general direction, elevation, or location, coordinate for the proper allocation of the space position. If necessary, consult the Architect/Engineer, whose decision shall be final.

E. Wherever work is to be concealed or installed above ceilings, maintain adequate clearance to allow for access, repairs, and removal of all devices.

F. Coordinate setting of sleeves, anchor bolts, and inserts as required to accommodate equipment before concrete is set and masonry is placed.

1.9 ELECTRICAL CHARACTERISTICS, MOTORS, MOTOR STARTERS, CONTROLS, AND WIRING

A. Electrical Characteristics: Refer to electrical section for electrical characteristics of motors specified or scheduled under the Mechanical Section.

B. Motor Sizes: Motor horsepower specified in Mechanical Section and/or indicated on mechanical drawings are approximate, and are not intended to limit motor sizes. Each motor shall be of proper size to operate continuously the actual equipment driven thereby, without overload on motor under all operating conditions, except as otherwise specified.

C. Motor starters and other electrical control devices: Motor starters for mechanical equipment motors shall be furnished by mechanical contractor. Also, provide electrical control devices required for the Mechanical system, unless otherwise specified.

D. All motor starters shall comply with specifications for motor starters as specified in Section 15058.

E. In addition to the items specified in Section 15058, starters that operate in parallel with other starters shall be equipped with auxiliary contacts on the main disconnect for breaking one leg of the control power. In these cases, the secondaries of the starter transformers shall be properly phased.

F. Installation of electrical devices, EXCEPT those devices that are factory mounted on equipment: electrical control devices which require electrical connections ONLY, shall be installed by contractor; electrical control devices which required piping, linkage, remote bulb, or other mechanical connections IN ADDITION TO electrical connections, shall be installed by contractor, ready for electrical connections. Electric wiring: All electric wiring required to operate the mechanical systems, EXCEPT wiring which is factory installed on equipment, shall be done by contractor, in accordance with approved wiring diagrams which shall be furnished by this Section.

G. Install name plates with full data on all motors, starters, and disconnect switches.

1.10 TRANSPORTATION AND HANDLING

A. Pay all transportation and handling charges. Immediately report any damage to equipment received to the carrier so that job progress will not be delayed.

B. All items received by the Contractor shall be left in their original containers, or as shipped, where possible, until installed in final locations.

C. All items shall be protected from the elements. If stored outside, provide blocking to raise the base of each item well above ground and/or water levels.

D. Provide additional protection for items subject to damage, where necessary, so that when installed, the items will be in new condition.

E. Supply electrical items that might be damaged by condensation with heated air in an enclosed area until placed into service.

1.11 CUTTING AND PATCHING

A. Execute cutting (including excavating), fitting, and patching of work required to:
   1. Make several parts fit properly.
   2. Uncover work to provide for installation of ill timed work.
   3. Remove defective work.
   4. Remove work not complying with the requirements of the contract documents.
   5. Remove samples of installed work as specified for testing.
   6. Where work is cut for any reason, restore cut and damaged areas with new materials meeting requirements of the contract documents.

B. In addition to the requirements above and upon written instructions of the Architect/ Engineer, provide cutting, fitting, and patching to:
   1. Uncover work to provide observation of covered work.
   2. Remove samples of installed materials for testing.

C. Do not endanger work by cutting or altering work or any part of it.

D. Prior to cutting that affects structural safety of project, submit written notice to Architect/Engineer requesting consent to proceed with cutting, including:
   1. Identification of project.
   2. Description of affected work.
   3. Necessity for cutting.
   4. Affect on other work and on structural integrity of project.
   5. Description of proposed work. Designate scope of cutting and patching, trades to execute work, products proposed to be used, and extent of refinishing.
   6. Alternatives to cutting and patching.
   7. Designation of party responsible for cost of cutting and patching.

E. Prior to cutting and patching done on the instruction of the Architect/Engineer, submit cost estimate.

F. Should conditions of work or schedule indicate the need for change of materials or methods, submit written recommendations Architect/Engineer, including conditions indicating the need for change, recommendations for alternative materials or methods, submittals as required for substitution of materials, and cost estimate for changing materials or methods.

G. Submit written notice designating time work will be uncovered to provide for observation.

H. Costs caused by ill timed or defective work and work not complying with requirements of the contract documents, including costs of additional services of Architect/Engineer, shall be borne by the party responsible for the ill timed, defective, or non-complying work.

1.12 INSTRUCTION TO OWNER/OPERATING PERSONNEL

A. The Contractor shall furnish the services of factory trained instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. The instruction will be for 8 hours. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given after the equipment or system has been accepted for regular operation. When significant changes or modifications in the equipment or system are made under the terms of the contract, additional instruction shall be provided to acquaint the operating personnel with the changes or modifications.

## PART 2 - PRODUCTS

2.1 MATERIALS, SUBSTITUTIONS, AND PRODUCT OPTIONS

A. Manufacturers or Trade Names:

1. The use of manufacturer's names and catalog numbers in these specifications or on the drawings indicates the type, size, rating, capacity, design, quality, or kind of materials required, and a closed specification is not intended, and similar and equal products of any reputable manufacturer which will satisfactorily perform the required functions will be acceptable, unless otherwise indicated by the words NO SUBSTITUTES, or unless otherwise specifically stated. The Architect/Engineer reserves the right to reject all materials which he deems not equal to those specified, or which he decides will not satisfactorily perform the required functions.
2. Any manufacturer providing equipment for this project shall provide a written guarantee to the Contractor stipulating that any parts used in the equipment so provided will be readily available for a minimum of ten years from date of shipment from the factory. The Contractor shall, in turn provide the Owner with these guarantees in the brochures submitted covering all the equipment used.

2.2 VALVE TAG IDENTIFICATION

A. Minimum 1-1/2 inch diameter.

B. Brass or aluminum.

C. Identifying numbers and letters shall be stamped 1/4 inch (minimum) height.

D. Fasten to valve with 18 (minimum) gauge solid copper or galvanized steel wire.

2.3 NAME PLATE IDENTIFICATION

A. Four by two inch (minimum) size engraved and laminated plastic nameplate or black lamicoid sheet with white lettering.

2.4 PIPE IDENTIFICATION

A. Brady B-500 or equal self-sticking vinyl cloth markers and pipe marker arrows.

2.5 MOTORS

A. All motors 10 hp and larger shall be high efficiency motors in accordance with NEMA MA-1-12.53b and IEEE l12A, Test Method B, with guaranteed minimum efficiency of 88.5 percent, an across-the-line minimum power factor of 85 percent (for synchronous speeds of 1,800 and 3,600 rpm), and a service factor of 1.15.

B. Every electric motor shall comply with NEMA Standard and be sized and designed to operate continuously at full load and full speed without causing noise, vibration, or temperature rise in excess of its rating.

C. Motors on belt drive equipment shall be furnished with apparatus for belt tension adjustment slide rails, idler pulley, or similar.

D. Motors shall be of sufficient size for the duty to be performed and shall not exceed the motor's full rated load when the driven equipment is operating at specified capacity under the most

severe conditions likely to be encountered. Insulation shall be Class F with Class B rise and moisture, fungus, and oil resistant treatment and shall be of a type designed and constructed to withstand the severe moisture conditions and the wide range of ambient temperature to which the motors will be subjected. Unless otherwise specified, all motors shall have open drip-proof frames and shall be rated for continuous full load operation without exceeding the standard temperature rise permitted for the frame construction and class of insulation used.

## PART 3 - EXECUTION

3.1 FIELD TESTS

A. All piping shall be free of leaks, and test gauges shall show no loss of pressure for at least 30 minutes after source of test pressure has been cut off, or as noted. Pipes may be tested in sections as the work progresses. Repair and retest all sections failing to pass tests, as required to obtain approval of tests. No caulking, welding, or brazing will be permitted on threaded pipe or fittings to stop leaks. Replace with new material all cracked or otherwise defective pipe and fittings of all types, as approved. Furnish suitable testing equipment, give all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal or insulate piping and do not conceal ductwork until all inspections have been made and all required tests have been approved by all applicable authorities. Submit results for review.

B. Provide required labor, material, equipment, and connections.

C. Test all piping, EXCEPT as otherwise specified below, as follows: hydrostatic test, at 150 percent of normal operating pressure of piping involved, or 100 psi, whichever is higher, AFTER removing all air from piping involved in test.
   1. Natural gas and fuel oil piping: 50 psi test using air or inert gas.
   2. Soil, waste, vent, roof drainage, and acid waste piping: standard water test, by filling piping with water up to top of vent stack or highest point of piping test section involved, but no section tested with less than a ten foot head with no pressure loss for at least 30 minutes.
   3. Test all equipment in accordance with sections specified hereinafter.

3.2 ADJUSTING AND CLEANING

A. Flush or blow all welding slag, pipe joint compound, loose scale, and other debris from pipework before connecting equipment thereto.

B. After systems have been tested and before any field painting is commenced, clean up all work thoroughly. Remove all foreign matter which has accumulated in ducts, casings, enclosures, fixtures, and equipment. Clean and polish all valves, plates, and other surfaces that are not to be painted, so that they present a new and acceptable appearance.

C. Put systems in operation, test all fixtures and other equipment, remedy all leaks and defects, make all necessary adjustments, and remove all air from water circulating systems. Adjust all air and water flows to indicated and/or required quantities, and adjust all controls and other items as required to balance system and provide uniform air flows and uniform temperatures in

air conditioned areas. Demonstrate that all controls and mechanical equipment function satisfactorily, as specified, as indicated, and as approved.

3.3 INSTALLATION

A. Equipment rooms and other areas in which equipment is to be installed have limiting dimensions. Install all mechanical work within these areas substantially as indicated, with ample unobstructed access space around each piece of equipment to facilitate proper installation, operation, and maintenance of equipment, and to allow ample space for plumbing, electrical, and other equipment indicated to be installed therein. Minor revisions in layout may be made subject to approval, but major changes in layout to accommodate proposed equipment which differs substantially from specified equipment in size and arrangement may not be considered. Each bidder shall determine before bidding that equipment upon which he proposes to base his bid will conform to these requirements. Install each equipment item in accordance with its manufacturer's recommendations, and as indicated on the drawings, and/or specified. If the drawings and/or specifications conflict with the manufacturer's recommendations, report this to the Architect/Engineer for his decision before proceeding with the work involved.

B. Generally, install pipework as follows unless otherwise indicated.
   1. Finished areas: conceal pipework within pipe chases, above suspended ceiling, and within other building construction, and other finished areas, unless otherwise indicated.
   2. Unfinished areas: install aboveground pipework exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impracticable, in mechanical and electrical equipment rooms, manufacturing areas, warehouse, or storage areas, and other unfinished areas.
   3. ALL areas: install pipework parallel or at right angles with beams, walls, ceilings, and other building lines, in straight lines between required direction changes, with vertical runs plumb. Install exposed pipework as close as practicable to walls, columns, ceilings, and overhead construction, and to provide maximum headroom and minimum interference with usable building space.

3.4 REMOVAL AND RELOCATION OF EXISTING WORK

A. Disconnect, remove or relocate material, equipment, piping, and other work noted and required by removal or changes in existing construction.

B. Provide new material and equipment related for relocated equipment.

C. Plug or cap active piping or ductwork behind or below finish.

D. Do not leave long dead end branches:
   1. Cap or plug as close to active line as possible.

E. Salvaged Existing Mechanical Materials and Equipment: Promptly haul away from Owner's premises all materials and equipment which are removed from existing system and are neither indicated nor required to be reused in the completed project, EXCEPT as otherwise specified. Owner may select certain removed existing materials and equipment and retain them for his future use. Before removing any existing materials and equipment, determine from Owner which of these materials and equipment he desires to retain. Remove all Owner selected materials and equipment without unnecessary damage thereto, and safely store them at locations designated by Owner.

3.5 CUTTING AND PATCHING

A. Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching and excavating and backfilling.

B. After uncovering work, inspect conditions affecting installation of new products.

C. Provide shoring, bracing, and support required to maintain structural integrity of the project.

D. Provide protection for other portions of the project.

E. Provide protection from the elements.

F. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.

G. Execute cutting and demolition by methods that prevent damage to other work and provide proper surfaces to receive installation of repairs and new work.

H. Refinish the entire surfaces where cutting and patching work occurs to provide an even, continuous surface to the nearest intersections. Where assemblies are damaged by cutting and patching, refinish entire assemblies.

3.6 PAINTING

A. All equipment shall be factory prime coated and painted, however, the following may be shop prime coated and made ready for painting:
1. Tanks.
2. Structural supports and frames.

B. Uncoated Hangers, Supports, Rods, and inserts shall be prime coated.

C. Exposed, uninsulated black steel piping, pipe supports, and pipe braces shall be prime coated.

D. Marred surfaces of prime coated or factory painted surfaces shall be painted and/or primed to match adjacent coat.

3.7 IDENTIFICATION

A. Identify valves, (including main pipe sectionalizing valves and branch valves) except those on or within hand reach of equipment controlled thereby with a minimum 1-1/2 inch diameter round brass or aluminum tag stamped with 1/4 inch (minimum) height letters designating material controlled by valve, and attached to valve body with 18 (minimum) gauge solid copper or galvanized steel wire. Submit a typed valve identification schedule with the operating instructions and parts list submittal described above under 1.5 SUBMITTALS.

B. Identify piping and ductwork with Brady B-500 or equal self-sticking vinyl cloth pipe markers and pipe marker arrows, each sized as recommended by marker manufacturer for outside diameter of pipe (including pipe insulation) labeled therewith. Marker background colors shall conform to OSHA and ANSI pipe identification standards. Each pipe marker shall be lettered to indicate the material contained in the pipeline involved, and arrows shall indicate direction of

material flow in the pipelines. Install appropriate pipe markers, each with a marker arrow adjacent thereto, on all above ground pipelines on 20 foot maximum centers, with at least one marker and arrow in each vertical run between floor and ceiling.

C. Equipment: Label each major mechanical equipment item with nameplate engraved with equipment designation and number, and securely attached to equipment.

**END OF SECTION 13010**

# SECTION 13050 – FIRE-SUPPRESSION MATERIALS & METHODS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Mechanical sleeve seals.
3. Sleeves.
4. Escutcheons.
5. Grout.
6. Fire-suppression demolition.
7. Concrete bases.
8. Supports and anchorages.

### 1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

### 1.3 SUBMITTALS

A. Welding certificates.

### 1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining CPVC Plastic Piping: ASTM F 493.

2.3 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.4 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

## 3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic 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. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

## 3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

## 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

**END OF SECTION 13050**

# SECTION 13072 – FIRE-SUPPRESSION VIBRATION & SEISMIC CONTROLS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restraining braces.

### 1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

### 1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

### 1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing

are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 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.

C. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

D. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.

C. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

G. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

## PART 3 - EXECUTION

3.1 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127 and NFPA 13.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3. Brace a change of direction longer than 12 feet.

C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 13 Section "Fire-Suppression Piping" for piping flexible connections.

**END OF SECTION 13072**

# SECTION 13121

# PRE-ENGINEERED BUILDINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

### 1.02 MATERIALS INCLUDED

A. Standard material furnished for metal building systems shall include primary and secondary structural framing members, bracing, metal panels for roofing and siding, flashings, fasteners, sealants, accessories, and all other miscellaneous component parts required for a complete building (with the exception of anchor rods and other embedded items, which are excluded). Insulation and other specific items beyond the scope of standard material shall also be furnished if shown or called for by contract documents.

### 1.03 DRAWINGS AND CALCULATIONS

A Provide erection information and drawings as required to assemble all parts, components, and accessories furnished. Drawings shall include, but not be limited to, roof framing plan, wall framing elevations, cross-sections, etc.

B. Design members to withstand all rooftop equipment loads.

C. Framing members shall be designed to stay within the constraints of the architectural features including walls, and ceilings. Tapering of columns shall occur above the ceiling only.

### 1.04 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit shop drawings to the Architect prior to fabrication. Fabrication shall not proceed until the architect and engineer of record have approved the shop drawings. Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

C. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

### 1.05 QUALITY ASSURANCE

A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Arkansas.
   1. Design Engineer Qualifications: Licensed in Arkansas.
   2. Conform to applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authority and provide data as requested.

B. Perform work in accordance with AISC 360 - Specification for Structural Steel Buildings.

C. Perform welding in accordance with AWS D1.1.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Erector Qualifications: Company specializing in performing the work of this section with minimum three years experience. Erection shall be performed by a qualified erector using proper tools and equipment. It shall be the responsibility of the erector to comply with all applicable legal and safety requirements. It shall further be the responsibility of the erector to determine and provide any and all temporary bracing, bridging, blocking, shoring, and/or securing of components, etc. as required for stability during the entire erection process. Erector shall not make any field modifications to any structural member except as authorized by PEMB manufacturer.

**1.06 DESIGN**

A. All structural steel mill sections and welded plate members shall be designed in accordance with the applicable sections, relating to design requirements and allowable stresses, of the American Institute of Steel Construction (AISC) “Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design.”

B. All light-gauge, cold formed, structural members and covering shall be designed in accordance with the applicable sections, relating to design requirements and allowable stresses, of the American Iron and Steel Institute (AISI) “Specification for the Design of Cold Formed Steel Structural Members.”

**1.07 DESIGN LOADS**

A. Design load requirements shall be determined by local conditions, applicable codes, building end use, etc. Refer to contract structural drawings. Application of design loads shall be in accordance with the Design Practices sections of the Metal Building Manufacturers Association (MBMA) current edition “Low Rise Building Systems Manual” unless specified otherwise.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A. Metal Buildings:
   1. Ceco Building Systems: www.cecobuildings.com.
   2. Pinnacle Structures: www.pinnaclestructures.com.
   3. Substitutions: See Product Requirements.

**2.02 METAL BUILDING**

A. Bay Spacing: See drawings.

B. Primary Framing: Rigid frame, multi-span of rafter beams, columns and wind bracing.

C. Secondary Framing: Purlins, Eave struts, and other items detailed.

D. Roof Slope: See Drawings.

E. All framing members shall be cleaned to remove loose rust and mill scale, and given one shop coat of primer. Primer shall be formulated to equal or exceed performance, under laboratory conditions, requirements of U.S. Federal Specification SSPC 15. The base metal shall be thoroughly cleaned then treated with iron phosphate solution to enhance paint adherence before coil is coated with a red oxide polyester paint. Paint dry film thickness shall be 1 mil on both sides. Do not shop prime surfaces to be field welded.

**2.03 MATERIALS – PRIMARY MEMBERS**

A. Primary structural framing shall refer to the Primary Frames (transverse rigid frames and lean-to rafters/columns), expandable and non-expandable End Frames (rafters/corner posts/end posts). Wind/Seismic Bracing, and Crane Systems.

   1. Sheet, plate, strip mill plate, plate coils and flat bar stock used to fabricate welded-up, structural members shall conform to one of the following ASTM specifications as appropriate: ASTM A-572, Grade 50; ASTM A-529, Grade50; ASTM A-1011-HSLAS,

Grade 50 Class 1.

2. Members fabricated from W shapes (hot-rolled structural sections) will conform to one of the following ASTM specifications: ASTM A-529, Gr. 50; ASTM A-572, Grade 50 or ASTM A-992, Grade 50.
3. Members fabricated from other hot-rolled structural sections (S shapes, American Standard channels, angles, and all other miscellaneous structural shapes) shall conform to ASTM A-529, Grade 50 or ASTM A-572, Grade 50.
4. Interior columns of multi-span frames will be fabricated from round pipe or tube column sections which have minimum yield strength of 42,000 psi and conform to physical specifications of ASTM A-500, Grade B.
5. Rods used for bracing will conform to the physical specifications of ASTM A529, Gr. 50.
6. Cables used for bracing shall be zinc coated steel wire (7 strands), in conformance with ASTM A-475 EHS, Class A.
7. Members fabricated by cold forming process shall conform to ASTM specification ASTM A-1011, Grade 55 or ASTM A-1011-HSLAS, Grade 55, Class 1.

B. See structural documents for other criteria. Structural documents shall override this section if a discrepancy occurs.

**2.04 MATERIALS – SECONDARY MEMBERS**

A. Secondary structural framing shall refer to purlins, girts, eave struts, base members, flange bracing, gable angles, clips and other miscellaneous structural parts.

1. Purlins, girts, eave struts, base members and gable angles shall be cold-formed from steel conforming to ASTM specification A-1011, SS, Grade 55 or ASTM A-1011-HSLAS, Grade 55, Class 1.

1.1 Purlins are roll formed “Z” sections 8” deep. Each “Z” section flange has a stiffening lip formed at 50° to the flange.

1.2 Eave struts are roll formed “C” sections 8” deep with 3 3/8" wide top flange and 5” wide bottom flange. Flanges are formed at angles other than 90 to the web to accommodate various roof slopes. Each flange has a stiffening lip formed at 90 degrees to the flange.

2. Galvanized cold-formed material shall conform to ASTM specification A653-06 SS grade 50, class 1 or 3 with minimum Fy = 55 ksi, Fu = 70 ksi, G90 coating.
3. All other miscellaneous secondary members shall have minimum yield strength of 36,000 psi.

**2.05 CONNECTIONS**

A. All field connections shall be bolted unless otherwise noted.

1. All primary bolted connections, as shown on drawings, shall be furnished with high strength bolts conforming to ASTM specification ASTM A-325.
2. All secondary bolted connections, as shown on drawings, will be furnished with machine bolts conforming to ASTM specification ASTM A-307 unless ASTM A-325 bolts are required by design.
3. The standard A307 and A325 bolts shall be uncoated.
4. All connections using machine bolts in conformance with ASTM A-307 shall use nuts in conformance with ASTM specification ASTM a-563 Grade A Hex. Connections using high strength bolts in conformance with ASTM A-325 shall use nuts in conformance with

ASTM specification ASTM A-563 Grade C Heavy Hex.

5. All cast iron slope washers shall conform to ASTM specification A-48 Class 30 B.
6. Hardened Steel Washers in conformance with ASTM specification ASTM F-436, Type 1 carbon steel are available by special order.

B. All shop welding shall be by submerged arc, gas metal arc, or shielded arc process. Groove joint welds shall develop the full strength of the members connected. Welding shall conform to the applicable requirements of the American Welding Society “Structural Welding Code,” AWS D1.1-98 with ultrasonic test acceptance criteria modified in accordance with AWS D1.1-98 Section 6.8 based on suitability for service criteria.

**2.06 ROOF PANELS**

A. Roof Panels: See Section 07410.

**2.07 FLASHING, TRIM, GUTTERS AND CLOSURES**

A. Flashing and/or trim shall be furnished at eaves, rake, corners, base, framed openings, and wherever necessary to seal against the weather and provide a finished appearance. Color shall be selected from premium paint colors.

B. Eave gutters and downspouts shall be provided as indicated on drawings. Gutters are box-shaped with face profile shaped to match rake trim. Downspouts are rectangular-shaped to accommodate capacity with a 45 degree elbow at the bottom. Downspout colors shall be selected from premium paint color chart.

C. Preformed, closed cell, polyethylene closure strips matching the profile of the panel shall be installed along the eave and at other locations to provide weathertightness.

**2.08 FASTENERS**

A. Wall Fasteners shall be self-drilling carbon steel screws with an integral 5/16 inch hex washer head. Screws for “panel to structural” application shall be #12 diameter with a minimum length of 1 1/4 inches. “Stitch” screws shall be 1/4 inch diameter and 7/8 inches long.

B. Panel to structural screws shall have a sealing washer (PVC or EPDM).

C. Both “standard” and “optional” Wall Fasteners shall have carbon steel heads. Entire fastener (body and head) shall have 0.0005 inches minimum thickness zinc plating plus a polymer coating for long term corrosion resistance. Fastener head shall also be painted to match wall panel and/or trim color.

D. Roof Fasteners shall be self-drilling carbon steel screws with an integral 5/16" hex. washer head (washer face undercut to encapsulate a sealing washer). Screws for “panel to structural” application shall be #12 diameter with a minimum length of 1 ¼ inches. “Stitch” screws shall be 1/4 inch diameter and 7/8 inches long. Standard Roof Fasteners shall be screws with carbon steel heads and shall have a sealing washer (PVC or EPDM). Entire fastener (body and head) shall have 0.0005 inches minimum thickness zinc plating plus a polymer coating or long term corrosion resistance. When used with color coated material, fastener head shall also be painted to match panel and/or trim color.

**2.09 SEALANTS**

A. Sealants for side laps, end laps, accessories, etc. shall be a preformed, butyl rubber based compound. The material shall be non-hardening, non-shrinking and non-corrosive and shall have excellent adhesion to metals, painted surfaces and plastics at temperatures from -30°F to 160°F. These sealants shall be in tape mastic form, of shape and size recommended by MBM for various applications, and shall have paper backing for easy handling.

B. Tube sealants shall be used to supplement tape mastic sealants and shall be applied in locations indicated by erection instructions. Tube sealant shall be a synthetic, elastomer based

material which becomes tack-free in less than 2 hours at 75°F but retains flexibility.

**2.10 ROOF CURBS**

A. GENERAL:

1. The General Contractor shall provide all labor, material and equipment to completely install the prefabricated metal building Roof curbs.

2. The prefabricated metal building roof curbs shall be used on all roof penetrations, including but not limited to HAVC units, exhaust fans, skylights and duct openings.

B. CONSTRUCTION:

1. The prefabricated metal building roof curbs shall be constructed using minimum 0.080 Aluminum or 18 gauge AZ 55 prime Galvalume Plus steel, or heavier gauge (as required). Fully mitered and welded corners. Integral base plates and water cricket or diverter. Factory insulated curbs to utilize 1 1/2" thick, 3# density fiberglass insulation. Roof curbs must be fabricated with integral panel ribs creating a rib to rib installation.

2. Minimum height of roof curbs shall be 8" above finished roof or as specified.

3. The prefabricated metal building roof cubs shall be sloped to match the roof pitch and provide a level top.

4. INSTALLATION–The prefabricated metal building roof curbs must be installed in accordance with instructions and as detailed on drawings.

5. COORDINATION–The prefabricated metal building roof curb sizes and options shall be coordinated by curb supplier and the general contractor prior to fabrication.

6. WARRANTY–The prefabricated metal building roof curb shall be guaranteed to be free from defects in materials or workmanship for a period of 20 years.

**2.11 PIPE FLASHING**

A. Pipe flashing units shall be a one piece construction that accommodates pipes made of steel, cast iron, P.V.C. and sheet metal.

B. Unit may be specified in one of three sizes, as follows:

1. #3 size for1/4" to 4" outside pipe diameter.

2. #5 size for 4" to 7" outside pipe diameter.

3. #8 size for 7" to 13" outside pipe diameter.

**2.12 INSULATION SYSTEM**

A. Provide insulation system with fabric liner and strapping equal to Thermal Design Simple Saver System.

B. Configuration: R 13 + R 13 minimum.

C. Thermal Blocks: R 5

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

**3.02 ERECTION - FRAMING**

A. Erect framing in accordance with AISC 360 - Specification for Structural Steel Buildings.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

**3.03 TOLERANCES**

A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

**3.04 WARRANTIES**

A. MATERIAL AND WORKMANSHIP:

1. Provide a one (1) year limited warranty against failures caused by faulty or substandard material within limits set by the warranty.

2. Provide a one (1) year workmanship guarantee against failures caused by faulty erection.

B. PAINT:

1. Provide a twenty five (25) year warranty against fade, chalk, peel, crack, check or chip.

**END OF SECTION**

# SECTION 13930 – WET-PIPE FIRE-SUPPRESSION SPRINKLERS

## PART 1 - GENERAL

### 1.1 SUMMARY

Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

### 1.2 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

### 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Maximum Protection Area per Sprinkler: Per UL listing.

C. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For 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.

D. Qualification Data: For qualified Installer and professional engineer.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

F. Welding certificates.

G. 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."

H. Field quality-control reports.

I. Operation and maintenance data.

1.5 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 engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

## PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

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; 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. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

F. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

K. Steel Pressure-Seal Fittings: UL 213, FM-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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Victaulic Company.

## 2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel 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: 175 psig.

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AFAC Inc.
    b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    c. Anvil International, Inc.
    d. Clow Valve Company; a division of McWane, Inc.
    e. Crane Co.; Crane Valve Group; Crane Valves.
    f. Fire-End & Croker Corporation.
    g. Fire Protection Products, Inc.
    h. Globe Fire Sprinkler Corporation.
    i. Groeniger & Company.
    j. Matco-Norca.
    k. Metraflex, Inc.
    l. Milwaukee Valve Company.
    m. Mueller Co.; Water Products Division.
    n. NIBCO INC.
    o. Potter Roemer.
    p. Reliable Automatic Sprinkler Co., Inc.
    q. Shurjoint Piping Products.
    r. Tyco Fire & Building Products LP.
    s. United Brass Works, Inc.
    t. Venus Fire Protection Ltd.
    u. Victaulic Company.
    v. Viking Corporation.
    w. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

C. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    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.

D. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    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. Hammond Valve.
    f. Milwaukee Valve Company.
    g. Mueller Co.; Water Products Division.
    h. NIBCO INC.
    i. Shurjoint Piping Products.
    j. Tyco Fire & Building Products LP.
    k. United Brass Works, Inc.
    l. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

E. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    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.

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. Minimum Pressure Rating: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Affiliated Distributors.
b. Anvil International, Inc.
c. Barnett.
d. Conbraco Industries, Inc.; Apollo Valves.
e. Fire-End & Croker Corporation.
f. Fire Protection Products, Inc.
g. Flowserve.
h. FNW.
i. Jomar International, Ltd.
j. Kennedy Valve; a division of McWane, Inc.
k. Kitz Corporation.
l. Legend Valve.
m. Metso Automation USA Inc.
n. Milwaukee Valve Company.
o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.
r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AFAC Inc.
    b. Globe Fire Sprinkler Corporation.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Tyco Fire & Building Products LP.
    e. Venus Fire Protection Ltd.
    f. Victaulic Company.
    g. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, 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.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AFAC Inc.
    b. Reliable Automatic Sprinkler Co., Inc.
    c. 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 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    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.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anvil International, Inc.
    b. National Fittings, Inc.
    c. Shurjoint Piping Products.
    d. Tyco Fire & Building Products LP.

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-T 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AGF Manufacturing Inc.
    b. Reliable Automatic Sprinkler Co., Inc.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
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.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Elkhart Brass Mfg. Company, Inc.
    b. Fire-End & Croker Corporation.
    c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AGF Manufacturing Inc.
    b. Triple R Specialty.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. CECA, LLC.
    b. Corcoran Piping System Co.
    c. Merit Manufacturing; a division of Anvil International, Inc.

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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fivalco Inc.
    b. FlexHead Industries, Inc.
    c. Gateway Tubing, Inc.

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.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

C. 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.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. 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.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Reliable Automatic Sprinkler Co., Inc.
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Globe Fire Sprinkler Corporation.
b. Tyco Fire & Building Products LP.
c. Victaulic Company.
d. Viking Corporation.

2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

2.11 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

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. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include "AIR" or "AIR/WATER" label on dial face.

2.12 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.

C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.

E. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.13 SLEEVES

A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set-screws.

2.14 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex, Inc.
4. Pipeline Seal and Insulator, Inc.

2.15 GROUT

A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink, and 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 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 2 Section "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

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.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

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.

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 will not be 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. Comply with requirements for heating cables in Division 15 Section "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Division 15 Section "Fire-Suppression Systems Insulation."

## 3.3 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. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

## 3.4 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. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install free-standing, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.7 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
5. Bare Piping in Equipment Rooms: One piece, cast brass.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.8 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 7 Section "Joint Sealants."

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 7 Section "Joint Sealants."

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. 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 firestop materials and installations in Division 7 Section "Through-Penetration Firestop Systems."

## 3.9 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

## 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 Division 16 Section "Electrical Identification."

## 3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

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. Start and run excess-pressure pumps.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.13 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.

B. Sprinkler specialty fittings may be used, downstream of control vales, instead of specified fittings.

C. Wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6 shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Thinwall black-steel pipe with plain ends; welding fittings; and welded joints.

**END OF SECTION 13930**

## SECTION 15010 – BASIC MECHANICAL REQUIREMENTS

## PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Heating, Ventilating and Air Conditioning Piping System.
B. Plumbing System.

1.2 RELATED SECTIONS

A. Heating, Ventilating, and Air Conditioning System: As described by the following sections.
1. Section 15050 – Basic Mechanical Materials and Methods
2. Section 15058 – Motor Requirements for HVAC Equipment
3. Section 15060 – Hangers & Supports
4. Section 15074 – Vibration and Seismic Controls
5. Section 15083 – HVAC Insulation
6. Section 15183 – Refrigerant Piping.
7. Section 15190 – Mechanical Identification
8. Section 15732 – Packaged, Outdoor, Central-Station Air-Handling Units
9. Section 15738 – Split-System Air-Conditioning Units.
10. Section 15739 – Mini-Split-System Air-Conditioning Units.
11. Section 15815 – Metal Ducts
12. Section 15820 – Duct Accessories
13. Section 15838 – Power Ventilators
14. Section 15855 – Diffusers, Registers, and Grilles
15. Section 15950 – Testing, Adjusting, and Balancing

B. Plumbing System: As described by the following Sections.
1. Section 15050 – Basic Mechanical Materials and Methods.
2. Section 15060 – Hangers and Supports.
3. Section 15074 – Vibration and Seismic Controls.
4. Section 15082 – Plumbing Insulation.
5. Section 15111 – General-duty Valves for Plumbing Piping.
6. Section 15126 – Meters and Gages for Plumbing Piping.
7. Section 15140 – Domestic Water Piping.
8. Section 15150 – Sanitary Waste and Vent Piping.
9. Section 15190 – Mechanical Identification.
10. Section 15410 – Plumbing Fixtures.

C. Fire Protection Systems: As described by the following Sections.
1. Section 13010 – General Provisions Fire Protection.
2. Section 13050 – Fire Suppression Materials and Methods.
3. Section 13072 – Fire Suppression Vibration and Seismic Controls.
4. Section 13930 – Wet Pipe Fire Suppression Sprinklers.

1.3 PLUMBING SYSTEM DESCRIPTION

A. Provide complete operational plumbing system as follows:
1. Sanitary Waste and Vent System.
2. Domestic water system.
3. Condensate drain system.

1.4 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM DESCRIPTION

A. Provide complete operational heating, ventilating and air conditioning system as follows:
   1. Air distribution system consisting of ductwork, accessories, etc.
   2. Controls.
   3. Testing, adjusting and balancing.
   4. Insulation.
   5. Exhaust fans.
   6. Air handling units.

1.5 FIRE PROTECTION SYSTEM DESCRIPTION

A. Provide a complete operational fire protection system.

1.6 SUBMITTALS – ACTION

A. Submit action, informational, and closeout submittals under provisions of Section 01. Submit record drawings under provisions of Section 01 and this section.

B. All equipment shall be submitted, with descriptive data, to the Architect for approval or rejection. All equipment shall be submitted in an indexed, bound brochure with six copies. All items shall be submitted at one time. Partial pre-submittals will be considered only as expediency upon special request.

C. Each submittal brochure shall be signed, on the index page by Contractor. This signature shall indicate the Contractor has examined all data therein and found same to be in order.

D. HVAC, Plumbing, and Fire Protection data shall be organized as follows:
   1. Per specification section.

1.7 COORDINATION

A. The Contractor shall be guided by the architectural details and conditions existing at the job, correlating this work with that of the other trades, and report to the Architect any discrepancies or interferences that are discovered. Failure to report such discrepancies and interferences shall result in the correcting of these errors or omissions by the Contractor at his own expense. All work installed under this division, which deviates from the drawings, and specifications without prior approval of the Architect shall be altered by the Contractor at his own expense to comply with the drawings and specifications as directed by the Architect.

1.8 REGULATORY REQUIREMENTS

A. All work shall be executed and inspected in accordance with Arkansas codes, laws, ordinances, rules and regulations applicable to the particular class of work. The Contractor shall include in his quotation all applicable service charges, fees, permits, royalties, and other similar costs in connection therewith. If, to the knowledge of the Contractor, the drawings or specifications are at variance with the above-mentioned laws, rules and regulations, he shall promptly notify the Architect in writing so any necessary changes can be provided for in his contract. If the Contractor performs any work without notice as required above, he shall bear all costs arising there from.

1.9 PROJECT RECORD DOCUMENTS

A. Plumbing System: Provide record drawings indicating final plumbing system. Indicate

exact location of exterior lines, cleanouts, etc.

B. Heating, Ventilating, and Air Conditioning System: Provide record drawings indicating final loop field as-built conditions.

C. Fire Protection System: Provide record drawings indicating final systems.

1.10 WARRANTIES

A. Provide manufacturer and extended contractor warranties as specified by individual sections hereinafter.

1.11 JOB CONDITIONS

A. Examine related work and surfaces before starting work of any section.
1. Report to Architect, in writing, conditions which will prevent this work.
2. Installed work which interferes with architectural or any other work, or which deviates from drawings and specifications without Architect's prior approval, shall be altered by DIVISION 15 - MECHANICAL, without cost to Owner, to clear such interferences, or to comply with the drawings and specifications. Interferences or discrepancies that may be discovered or anticipated shall be reported promptly to the Architect for his decision before proceeding with the work involved.

## PART 2 - PRODUCTS

2.1 GENERAL

A. Latent defects arising during this period shall, upon notification by the Owner and Architect, be promptly corrected by the contractor at no additional cost to the Owner.

2.2 MATERIALS AND EQUIPMENT

A. Use only new and undamaged materials as specified in the respective related sections.

2.3 SUBSTITUTIONS

A. Submit only materials, which meet or exceed all requirements of those specified. Administrative procedures for Substitutions are specified in Section 01.

2.4 STARTERS

A. Furnish all Motor Starters and Motor Controllers required for all HVAC and Plumbing work. Starters shall be as required for each service and shall include all auxiliary inputs necessary to accomplish all sequences of operations or shut-down. All starters to be a single manufacturer and of the "maintained" contact type.

B. All starters to be fused combination type.

## PART 3 - EXECUTION

3.1 EXECUTION

A. Execute all work in accordance with the requirements of the Contract Documents.

B. Install all equipment, devices, accessories, etc. in accordance with the Manufacturer's installation guidelines and recommendations.

C. The space between the top of the finished ceiling and the underside of the floor or roof is a plenum. This area is permitted to supply air to, or return air from, occupied spaces. For these air-handling spaces, all materials are required to be noncombustible or limited combustible with a maximum smoke index of 50 (based on UL 723, ASTM E84 or NFPA 255).

3.2 WORKMANSHIP

A. All work required by the respective related sections shall be performed by a mechanic or craftsman with a demonstrated ability to perform the work required.

B. Perform all work to local established trade standards.

3.3 COORDINATION

A. Wherever work is to be concealed or installed above finished ceiling, maintain adequate clearance to allow for access, repairs and removal of all devices. The exact mounting heights of all equipment, ducts, piping, controls, etc. shall be sufficient to be above the level of the ceiling indicated to be installed on the Architectural drawings. The Contractor shall be responsible for protecting his installation from being blocked off by others. Should a conflict occur, bring the matter to the attention of the Architect or other trades for correction.

3.4 SEISMIC DESIGN

A. Mechanical systems shall be braced in accordance with the requirements of Local Code requirements in addition to bracing indicated on the documents

**END OF SECTION 15010**

# SECTION 15050 – BASIC MECHANICAL MATERIALS AND METHODS

## PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Mechanical identification.
2. Sleeves.
3. Mechanical sleeve seals.
4. Formed steel channel.

1.2 SUBMITTALS

A. Comply with requirements of Section 01.

B. Product Data: Mechanical Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

## PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION

A. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light background color.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener. Color and Lettering: Conform to ASME A13.1.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Color and Lettering: Conform to ASME A13.1.

E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Identification products shall be equivalent to Marking Services Incorporated available at www.markserv.com.

2.2 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Acrylic.

2.3 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. Substitutions: Permitted.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber-sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.4 FORMED STEEL CHANNEL

A. Manufacturers:
1. B-Line Systems.
2. Unistrut Corp.
3. Substitutions: Permitted

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

## PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - MECHANICAL IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

3.3 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

**END OF SECTION 15050**

# SECTION 15058 – MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

## PART 1 - GENERAL

### 1.1 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.

### 1.2 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.

### 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.

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. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F, unless otherwise indicated.

I. 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.

## 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.

## 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

3.1 MOTOR STARTER INSTALLATION

A. Install per manufacturer's recommendations.

B. Coordinate location with Division 16.

3.2 ADJUSTING MOTORS

A. Use adjustable motor mounting bases for belt-driven motors.

B. Align pulleys and install belts.

C. Tension according to manufacturer's written instructions.

**END OF SECTION 15058**

# SECTION 15060 – HANGERS & SUPPORTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. See Division 15 Section "Metal Ducts" for duct hangers and supports.

### 1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

### 1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

### 1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Grinnell Corp.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Grinnell Corp.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. Pipe Shields, Inc.
3. Rilco Manufacturing Company, Inc.
4. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. 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.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, 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 APPLICATIONS

A. Specific hanger and support requirements are specified 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 padded hangers for piping that is subject to scratching.

F. 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. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
6. 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.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

8. 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.

G. 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 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. 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.

I. 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. 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.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

J. 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.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

## 3.2 HANGER AND SUPPORT INSTALLATION

A. Steel 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 building structure.

B. 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 above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

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 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. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

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 according to ASME B31.1 for power piping and 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.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
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 inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 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 smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 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 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touch Up: 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. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 15060**

# SECTION 15074 – VIBRATION AND SEISMIC CONTROLS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Restraining braces and cables.

### 1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. The engineer shall be licensed in this State.

C. This project is located in Pocahontas, Arkansas. Seismic forces shall comply with this location. Provide a submittal of all seismic component including gas pipe bracing and locations for each brace. Indicate method of recommended attachment for all equipment and ductwork.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Field quality-control test reports.

### 1.3 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval

by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amber/Booth Company, Inc.
   2. Kinetics Noise Control.
   3. Mason Industries.
   4. Vibration Eliminator Co., Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

   1. Resilient Material: Oil- and water-resistant.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

   1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
   2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

   1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
   2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: 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 for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate 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. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or 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. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: 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. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

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.
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.

K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Cooper B-Line, Inc.; a division of Cooper Industries.
3. Hilti, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. TOLCO Incorporated; a brand of NIBCO INC.
7. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

G. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

## PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 7 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. 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.

H. 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

## 3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

## 3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.

8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION 15074**

# SECTION 15082 – PLUMBING INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes preform rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 15 Section "HVAC Insulation."

C. Provide insulation minimum 1” on all PVC piping used in a plenum.

### 1.2 RELATED SECTIONS

1. Section 15010 – Basic Mechanical Requirements. See this section for submittals and other contract related requirements.

2. Section 15050 – Basic Mechanical Materials and Methods. See this section for labeling requirements.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

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.
8. Detail field application for each equipment type.

C. Field quality-control reports.

### 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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.

## PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

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.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is

2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Johns Manville; MicroFlex.
    b. Knauf Insulation; Pipe and Tank Insulation.
    c. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Insulco, Division of MFS, Inc.; SmoothKote.
    b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    c. Rock Wool Manufacturing Company; Delta One Shot.

## 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. Products: Subject to compliance with requirements, provide one of the following:

    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, 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).

## 2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Products, Division of ITW; CP-35.

b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, 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, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. Marathon Industries, Inc.; 550.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

## PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and 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 as recommended by insulation material manufacturer 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.

## 3.3 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 Division 7 Section "Through-Penetration Firestop Systems" 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 Division 7 Section "Through-Penetration Firestop Systems."

3.4 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, vessels, and equipment. 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.

## 3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

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.

3.6 MINERAL-FIBER INSULATION INSTALLATION

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 but 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.

3.7 FINISHES

A. Equipment and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting 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.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, 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 one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
2. 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 Insert number 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.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot, and Recirculated Hot Water: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I, with jacket, vapor retarded required, and painted where exposed to view: 1 inch thick.

B. Condensate, Stormwater and Overflow: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I, with jacket, vapor retarded required, and painted where exposed to view: 1 inch thick.

C. Roof Drain and Overflow Drain Bodies: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I, with jacket, vapor retarded required, and painted where exposed to view: 1 inch thick.

**END OF SECTION 15082**

# SECTION 15083 – HVAC INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulation cements; field-applied jackets; accessories and attachments; and sealing compounds.
2. Provide fire barrier wrap around kitchen grease exhaust as listed within.

B. Related Sections:
1. Division 15 Section "Plumbing Insulation."

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
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.
8. Detail field application for each equipment type.

C. Field quality-control reports.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting 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.

## PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Duct Wrap.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning; All-Service Duct Wrap.
      f.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; Commercial Board.
      b. Fibrex Insulations Inc.; FBX.
      c. Johns Manville; 800 Series Spin-Glas.
      d. Knauf Insulation; Insulation Board.
      e. Manson Insulation Inc.; AK Board.
      f. Owens Corning; Fiberglas 700 Series.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Insulco, Division of MFS, Inc.; SmoothKote.
      b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
      c. Rock Wool Manufacturing Company; Delta One Shot.

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. Products: Subject to compliance with requirements, provide one of the following:
   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, 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).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
   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, 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, 59 percent by volume and 71 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, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Products; Bands.
      b. PABCO Metals Corporation; Bands.
      c. RPR Products, Inc.; Bands.

## 2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

## 2.9 FIRE RATED DUCT WRAP INSULATION

A. 3M Fire Barrier Duct Wrap 15A: non-asbestos, biosoluble, patented inorganic fire resistant blanket encapsulated with a scrim-reinforced foil, blanket thickness of 1.5 inches for kitchen exhaust grease duct applications. Products supplied by 3M Fire Protection Products to the following system design Listings for the intended application:

B. 3M Fire Barrier Duct Wrap 20A: non-asbestos, biosoluble, patented inorganic fire resistant blanket encapsulated with a scrim-reinforced foil, blanket thickness of 2.0 inches for kitchen exhaust grease duct applications. Products supplied by 3M Fire Protection Products to the following system design Listings for the intended application:
   1. Ventilation Air Ducts: UL Design No. V-27 or Intertek Design No. 3MU/FRD-120-15.
   2. Kitchen Exhaust Grease Ducts: Intertek Design Listing No's. GD 531 F, GD 547 F, GD 556 F or GD 557 F.

3. Firestop Listings: UL Design Nos. W-L-7180, W-J-7104, C-AJ-7096 or Intertek Design No's. FS 557 W – FS 563 W, FS 565 W – FS 574 F, FS 576 F, FS 578 F, FS 579 W._

## PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and 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 as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and 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.

## 3.3 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. 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.

F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. 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. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.4 MINERAL-FIBER INSULATION INSTALLATION

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 1 edge and 1 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 2 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.

B. Board 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, space 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. 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 1 edge and 1 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 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. 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.

## 3.5 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 7 Section "Through-Penetration Firestop Systems."

## 3.6 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting 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.

## 3.7 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. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

2. Inspect field-insulated equipment, 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 one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 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 nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.

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.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Round Supply-Air & Return Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density with foil and paper field-applied jacket and vapor retarder.

B. Rectangular Supply-Air and Return Duct and Plenum Insulation: Mineral-fiber board 2 inches thick and 1.5-lb/cu. ft nominal density or Mineral-fiber blanket with pins, with glass cloth filed-applied jacket and vapor retarder.

C. Insulated exhaust ductwork within 10-feet of the exterior wall or louver.

**END OF SECTION 15083**

# SECTION 15111 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Iron swing check valves.
5. Iron gate valves.

B. Related Sections:

1. Division 2 water distribution piping Sections for general-duty and specialty valves for site construction piping.
2. Division 15 plumbing piping Sections for specialty valves applicable to those Sections only.
3. Division 15 Section "Mechanical Identification" for valve tags and schedules.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 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.

E. Valves in Insulated Piping: With 2-inch stem 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. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

## 2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
d. Hammond Valve.
e. Legend Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

## 2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Hammond Valve.
    e. Legend Valve.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corporation.
    i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Hammond Valve.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Red-White Valve Corporation.
    i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 3.
    b. CWP Rating: 200 psig.
    c. Body Design: Horizontal flow.
    d. Body Material: ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

2.5 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Legend Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.6 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.

f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

## PART 3 - EXECUTION

3.1 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.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and 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 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
4. Bronze Swing Check Valves: Class 125, bronze 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 Swing Check Valves: Class 125, metal seats.
3. Iron Gate Valves: Class 125, NRS.

**END OF SECTION 15111**

# SECTION 15126 – METERS AND GAGES FOR PLUMBING PIPING

## PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Operation and maintenance data.

## PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flo Fab Inc.
b. Miljoco Corporation.
c. Palmer Wahl Instrumentation Group.
d. Tel-Tru Manufacturing Company.
e. Trerice, H. O. Co.
f. Weiss Instruments, Inc.
g. 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 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: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. 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 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK, Inc.; U.S. Gauge.
b. Ernst Flow Industries.
c. Flo Fab Inc.
d. Miljoco Corporation.
e. Palmer Wahl Instrumentation Group.
f. Tel-Tru Manufacturing Company.
g. Trerice, H. O. Co.
h. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
i. Weiss Instruments, Inc.
j. WIKA Instrument Corporation - USA.
k. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.

8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid 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 remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

K. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Industrial-style, liquid-in-glass type.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:

1. Industrial-style, liquid-in-glass type.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:

1. Industrial-style, liquid-in-glass type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:

1. Sealed, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Sealed, direct-mounted, metal case.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:

1. Sealed, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 100 psi.

**END OF SECTION 15126**

# SECTION 15140 – DOMESTIC WATER PIPING

## PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Domestic water piping.
2. Domestic water piping, above grade.
3. Flanges, unions and couplings.
4. Valves.
5. Relief valves.
6. Strainers.
7. Hose bibs.
8. Hydrants.
9. Water hammer arrestors.

B. Related Sections:
1. Section 02: Product and execution requirements for excavation and backfill, including utility trenching.
2. Section 07 – Through-Penetration Firestop Systems.
3. Section 08 - Access Doors and Panels.
4. Section 09 - Paints and Coatings.
5. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports for placement by this section.
6. Division 16 Specifications:
   a. Execution requirements for electric connections to equipment specified in this section.
   b. Product requirements for motors for placement by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A112.26.1 - Water Hammer Arrestors.
2. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:
1. ASSE 1011 - Hose Connection Vacuum Breakers.
2. ASSE 1019 - Vacuum Breaker Wall Hydrants, Frost Resistant Automatic Draining Type.

D. American Society for Testing and Materials:
1. ASTM B32 - Standard Specification for Solder Metal.

2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
4. AWWA C651 - Disinfecting Water Mains.
5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
7. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrester Standard.

1.3 SUBMITTALS – ACTION

A. Section 01 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
4. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.4 SUBMITTALS – INFORMATIONAL

A. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories if requested by Architect.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 EXTRA MATERIALS

A. Section 01 - Execution Requirements: Spare parts and maintenance products.

B. Furnish two packing kits for each size valve, two loose keys for outside wall hydrants.

## PART 2 PRODUCTS

2.1 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Copper:
1. Tubing: ASTM B88, Type K, annealed.
2. Fittings: ASME B16.18, cast bronze or ASTM B16.22 wrought copper and bronze.
3. Joints: ASTM B32, solder, grade 95TA.

B. PVC, AWWA:
1. Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.
2. Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.2 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron:
1. Pipe: AWWA C151 with cement mortar lining.
2. Fittings: AWWA C110, ductile iron, standard thickness.
3. Joints: AWWA C111, rubber gasket with 3/4 inch diameter rods.

B. Copper:
1. Tubing: ASTM B88, Type K, annealed.
2. No Joints.

2.3 WATER PIPING, ABOVE GRADE

A. Copper:
1. Tubing: ASTM B88, Type L, hard drawn.
2. Solder Fittings: ASME B16.22, wrought copper and bronze.
3. Joints: ASTM B32, solder, Grade 95TA.

2.4 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2 inches and Smaller:
1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Pipe Size 2 1/2 inches and Larger:
1. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.5 VALVES

A. Gate Valves:
1. Manufacturers:
a. Nibco: Model F-617-0.
b. Watts: Model F-563.
c. Substitutions: Section 01600 - Product Requirements.

2. 2 1/2 inches and Larger: MSS SP 70, iron body, bronze trim, outside screw and yoke, hand wheel, solid wedge disc, flanged ends.

B. Ball Valves:
1. Manufacturers:
a. Apollo: Model 77-100 Series.
b. Jomar: Model T-100-N.
c. Nibco: Model T-585-70.
d. Watts: Model B-6080.
e. Substitutions: Section 01600 - Product Requirements.
2. 2 inches and Smaller: MSS SP 110, bronze, two piece body, full port, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

C. Swing Check Valves:
1. Manufacturers:
a. Nibco: Model T-413.
b. Nibco: Model F-918.
c. Watts: Model B-5000.
d. Watts: Model F-511.
e. Substitutions: Section 01600 - Product Requirements.
2. 2 inches and Smaller: MSS SP 80, bronze body and cap, bronze swing disc with rubber seat, threaded ends.
3. 2-1/2 inches and Larger: MSS SP 71, iron body, bronze swing disc, renewable disc seal and seat, flanged ends.

D. Spring Loaded Check Valves:
1. Iron body, bronze trim, stainless steel springs, bronze disc, wafer style ends.

2.6 RELIEF VALVES

A. Pressure Relief:
1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuate

B. Temperature and Pressure Relief:
1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME Section IV certified and labeled.

2.7 STRAINERS

A. 2 inch and Smaller: Cast bronze body, Y pattern with 1/32 inch stainless steel perforated screen.

B. 2-1/2 inch to 5 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

C. 6 inch: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.8 HOSE BIBBS

A. Interior: Manufacturer, model, and type as indicated on drawings.

2.9 HYDRANTS

A. Wall Hydrant: Manufacturer, model, and type as indicated on drawings.

2.10 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 02.

B. Cover: Fill Type as specified in Section 02.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 02.

## PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavate

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Install underground ductile-iron piping according to AWWA C600.

B. Install underground copper tubing according to CDA's "Copper Tube Handbook."

C. Verify connection size, location, and invert are as indicated on Drawings.

D. Remove scale and dirt on inside of piping before assembly.

E. Excavate pipe trench in accordance with Section 02.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

J. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 02.
2. Maintain optimum moisture content of fill material to attain required compaction density.
3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
4. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope water piping minimum 0.25 percent and arrange to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15060.

H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09.

K. Install water piping in accordance with ASME B31.9.

L. Install copper press fittings in compliance with manufacturer’s installation instructions. Insert tubing fully into the fitting and mark the tubing at the shoulder of the fitting. Check the fitting alignment against the mark on the tubing to assure the tubing is fully inserted into the fitting. Press the joint using the crimping tool approved by the manufacturer.

M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 15060.

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install valves with stems upright or horizontal, not inverted.

P. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

Q. Install gate or ball valves for by-pass, shut-off, and to isolate equipment, part of systems, or vertical risers.

R. Provide spring loaded check valves on discharge of water pumps.

S. Provide flow controls in water circulating systems as indicated on Drawings.

T. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

U. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

3.5 CLEANING

A. Section 01 - Execution Requirements: Final cleaning.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

E. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

**END OF SECTION 15140**

# SECTION 15150 – SANITARY WASTE AND VENT PIPING

## PART 1 GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer piping buried.
2. Sanitary sewer piping above grade.
3. Floor drains.
4. Cleanouts.

B. Related Sections:
1. Section 02: Product and execution requirements for excavation and backfill, including utility trenching.
2. Section 07 – Through-Penetration Firestop Systems.
3. Section 08 - Access Doors and Panels.
4. Section 09 - Paints and Coatings.
5. Section 15050 - Basic Mechanical Materials and Methods: Product requirements for pipe identification for placement by this section.
6. Section 15060 - Hangers and Supports: Product requirements for pipe hangers and supports for placement by this section.
7. Division 16 Specifications:
   a. Execution requirements for electric connections to equipment specified in this section.
   b. Product requirements for motors for placement by this section.

### 1.2 REFERENCES

A. American National Standards Institute:
1. ANSI B16.32 - Cast Copper Alloy Solder Joint Fittings for Sovent Drainage Systems.

B. American Society of Mechanical Engineers:
1. ASME A112.21.1 - Floor Drains.
2. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
3. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

C. American Society for Testing and Materials:
1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM B32 - Standard Specification for Solder Metal.
3. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
4. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
5. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
8. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. Cast Iron Soil Pipe Institute:
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

F. Plumbing and Drainage Institute:
   1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS – ACTION

A. Section 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

C. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
   4. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

1.4 SUBMITTALS – INFORMATIONAL

A. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment if requested by Architect or Mechanical Engineer.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 SANITARY SEWER AND STORM PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC:
1. Pipe size 4” and smaller: ASTM D1785.
2. Pipe size 6” and larger: ASTM D2665.
3. Fittings: ASTM D2665.
4. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
5. Installation: ASTM D2321.

2.2 SANITARY SEWER AND STORM PIPING, ABOVE GRADE

A. Cast Iron:
1. Pipe: ASTM A74 service weight.
2. Fittings: ASTM A74.
3. Joints: ASTM C564, neoprene gasket system, or lead and oakum.

B. Cast Iron:
1. Pipe: CISPI 301, hub-less, service weight.
2. Fittings: CISPI 301.
3. Joints: ASTM C564, compression gaskets and ASTM C1277 304 stainless steel shielded hubless couplings.

C. PVC: (Not allowed in ceiling return air plenums unless wrapped in compliance with code.)
1. Pipe size 4” and smaller: ASTM D1785.

2. Pipe size 6" and larger: ASTM D2665.
3. Fittings: ASTM D2665.
4. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
5. Installation: ASTM D2321.

2.3 CONDENSATE DRAIN PIPING, ABOVE GRADE

A. Copper:
1. Tube: ASTM B306, DWV.
2. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
3. Joints: ASTM B32, solder, Grade 50B.

B. PVC:
1. Pipe size 4" and smaller: ASTM D1785.
2. Fittings: ASTM D2665.
3. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
4. Installation: ASTM D2321.

2.4 FLOOR DRAINS

A. Cast iron body; Manufacturer, model, and type as indicated on drawings.

2.5 CLEANOUTS

A. Cast iron body; Manufacturer, model, and type as indicated on drawings.

2.6 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 02.

B. Cover: Fill Type as specified in Section 02.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 02.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection; size, location, and invert are as indicated on Drawings. Notify Architect if not the same.

B. Establish minimum separation from other services in accordance with code.

C. Remove scale and dirt on inside of piping before assembly.

D. Excavation and backfilling for utility trenches are specified in Section 02300.

E. Install pipe to elevation as indicated on Drawings.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

B. Encase exterior cleanouts in concrete flush with grade.

C. Install floor cleanouts at elevation to accommodate finished floor.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom. Do not spread piping, conserve space.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 15060.

J. Provide access where fittings are not accessible. Coordinate size and location of access doors specified in Section 08.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09.

N. Install bell and spigot pipe with bell end upstream.

O. Sleeve pipes passing through partitions, walls and floors.

P. Support cast iron drainage piping at every joint.

END OF SECTION 15150

# SECTION 15183 – REFRIGERANT PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

### 1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

### 1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L, ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. End Connections: Socket, union, threaded, or flanged.
6. Maximum Opening Pressure: 0.50 psig.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

B. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

C. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

D. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

E. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.

3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

F. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

G. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

E. Safety-Relief-Valve Discharge Piping:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps at strainers if they are not an integral part of strainers.

B. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

D. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
1. Thermostatic expansion valves.
2. Compressor.

E. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 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 Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. 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.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

P. Identify refrigerant piping and valves according to Section 15077 "Identification for HVAC Piping and Equipment."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

## 3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

## 3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 15062 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
1. Spring hangers to support vertical runs.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.

2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

## 3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

## 3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

## 3.8 ADJUSTING

A. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

B. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.

C. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION 15183**

# SECTION 15190 – MECHANICAL IDENTIFICATION

## PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of mechanical products installed under Division 15.

1.2 RELATED SECTIONS

A. Section 09910 - Paints: Identification painting.

1.3 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

A. Submit product data under provisions of Division 0 and Division 1.

B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Submit manufacturer's installation instructions under provisions of Section 15010.

## PART 2 - PRODUCTS

2.1 MATERIALS

A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.

B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

D. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.

E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners or adhesive.

B. Plastic Tags: Install with corrosive-resistant chain.

C. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.

D. Plastic Tape Pipe Markers: Install complete around pipe in accordance with manufacturer's instructions.

E. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

F. Equipment: Identify air handling units, fan coil units, unit heaters, tower, heat transfer equipment, fans and associated starters with engraved nameplates. Designations to match the record drawings. All lettering shall be minimum 3/4 inch tall.

G. Controls: Identify control panels and major control components outside panels with engraved nameplates.

H. Valves: Identify valves in main and branch piping with tags.

I. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 12 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction. Increase frequency in congested areas and in all mechanical equipment rooms.

J. Duct access doors, service panels or removable sections shall be identified with lettering no less than 1/2 inch tall to indicate the type of control, fire protection or smoke protection device(s) within. Comply with NFPA 90 A.

**END OF SECTION 15190**

# SECTION 15410 – PLUMBING FIXTURES

## PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sinks.

B. Related Sections:
1. Section 07: Sealant between fixtures and building components.
2. Section 15140 - Domestic Water Piping: Supply connections to plumbing fixtures.
3. Section 15150 - Sanitary Waste and Vent Piping: Waste connections to plumbing fixtures.
4. Division 16 Specifications: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. American Society of Mechanical Engineers:
1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Plumbing Fixture Fittings.
3. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
4. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
5. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS – ACTION

A. Section 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.4 SUBMITTALS – INFORMATIONAL

A. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 QUALITY ASSURANCE

A. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed products that conform to U.S. Access Board publication Architectural & Transportation Barriers Compliance Board "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

## PART 2 PRODUCTS

2.1 SINK

A. Manufacturer, model, and type as scheduled on drawings.

2.2 ALL PRODUCTS

A. As noted on schedules on drawings.

## PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Verify that casework and countertops are constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Install components level and plumb.

C. Install and secure fixtures in place.

D. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07, color to match fixture.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

F. For ADA accessible water closets, install flush valve with handle to wide side of stall.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Section 01 - Execution Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 - Execution Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

**END OF SECTION 15410**

# SECTION 15732 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes packaged, outdoor, central-station air-handling units with the following components and accessories:

1. Direct-expansion cooling.
2. Electric-heating coils.
3. Economizer outdoor- and return-air damper section.
4. Integral, space temperature controls

### 1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: RTUs shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Coordinate the installation requirements with the seismic vendor and submit seismic vendor’s calculations showing installation. Include a letter from the seismic vendor observing the installation with signoff following installation. The vendor shall be licensed in the State and Arkansas and shall sign and seal those calculations and letter.

### 1.3 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical data for each RTU, 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.

1. Wiring Diagrams: Power, signal, and control wiring.

### 1.4 INFORMATIONAL SUBMITTALS

A. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment’s literature pocket.

B. Warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data. Installation, Operation and Maintenance manual shall be supplied within the unit.

1.6 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 refrigerant system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

E. UL Compliance: Comply with UL 1995.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 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 Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. AAON, Inc.

2. Carrier Corporation.
3. Lennox Industries Inc.
4. McQuay International.
5. Trane; American Standard Companies, Inc.
6. YORK International Corporation.

2.2 CASING

A. All cabinet walls, access doors, and roof shall be have ½" foil face insulation.

B. Unit construction shall be G90 galvanized steel on both sides and a thermal break.

C. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

D. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

E. Access to filters, dampers, cooling coils, heaters, exhaust fans, compressors, and electrical and controls components shall be through hinged access doors with quarter turn handles, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

F. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.

G. Units with cooling coils shall include double sloped 304 stainless steel drain pans.

H. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

I. Unit shall include lifting lugs on the top of the unit.

J. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.

1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight. Thickness of insulation shall be 1-1/2" or ASHRAE 90.1 compliant.
2. Drain Connections: Threaded nipple.
3. Pan-Top Surface Coating: Corrosion-resistant compound.

K. Condensate Overflow Switch: Provide a condensate overflow switch to shutdown unit and provide an alarm on an overflow condition.

L. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 2.3 FANS

A. Direct drive supply fans.
1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motor. Air-Cooled Condenser
1. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
2. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
3. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

C. Seismic Fabrication Requirements: Fabricate fan section, internal mounting frame and attachment to fans, fan housings, motors, casings, accessories, and other fan section components with reinforcement strong enough to withstand seismic forces defined in Section 15074 "Vibration and Seismic Controls for HVAC Piping and Equipment" when fan-mounted frame and RTU-mounted frame are anchored to building structure.

D. Fan Motor: Comply with requirements in Section 15058 "Common Motor Requirements for HVAC Equipment."

## 2.4 COILS

A. Supply-Air Refrigerant Coil:
1. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
2. Coils shall have interlaced circuitry.
3. Coils shall be helium leak tested.
4. Coils shall be furnished with factory installed thermostatic expansion valves.
5. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

B. Outdoor-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

C. Electric-Resistance Heating:

1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

    a. Magnetic contactors.
    b. Step Controller: Pilot lights and override toggle switch for each step.
    c. SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
    d. Time-delay relay.

2.5 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:
1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection, independently circuited and carry a 5-year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

C. Hot Gas Reheat:
1. Provide hot gas reheat for the units scheduled. Provide humidity control to maintain a maximum of 56% relative (adjustable) in cooling mode.

2.6 AIR FILTRATION

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV-4) according to ASHRAE 52.2.

B. Units shall include 2" MERV 4.

2.7 DAMPERS

A. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper filter.

B. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.

1. Damper Motor: Modulating with adjustable minimum position.
2. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

C. Provide economizer with barometric relief damper installed on these on grade units.

2.8 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

B. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.

C. Unit shall be provided with a factory installed and factory wired 115V, 13 amp GFCI outlet disconnect switch in the unit control panel that is non-powered for external connection for maintenance use on each unit.

D. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

2.9 CONTROLS

A. Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:

a. Heat-cool-off switch.
b. Fan on-auto switch.
c. Fan-speed switch.

d. Automatic changeover.
e. Adjustable deadband.
f. Unoccupied-period-override push button.
g. 7-day occupancy schedule.
h. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.
i. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
j. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
k. Provide enthalpy sensors with enthalpy economizer.
l. Provide a BACnet interface for future connection by owner.

2.10 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

B. Coil guards of painted, galvanized-steel wire.

C. Hail guards of galvanized steel, painted to match casing.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Retain paragraph below for RTUs requiring wind or seismic restraints.

B. Install unit on concrete pad.

C. Install wind and seismic restraints according to manufacturer's written instructions. Provide a 14" tall curb on concrete pad and fasten curb to concrete per seismic vendors recommendations. Fasten RTU to curb.

D. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

E. Duct installation requirements are specified in other HVAC 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 Section 15820 "Duct Accessories."
4. Install return-air duct continuously through roof structure.
5. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.

3.2 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.

3.3 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.

END OF SECTION 15732

# SECTION 15738 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

## PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 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 Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings, , Trane; a business of American Standard companies. Or comparable product by one of the following or equal approved prior to bidding:
1. Lennox International Inc.
2. YORK; a Johnson Controls company.
3. Rheem.
4. Ruud
5. Trane
6. Carrier

2.2 INDOOR UNITS

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Filters: MERV-4, 2" pleated, throwaway type, three complete fills per unit.
9. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends), and to direct water toward drain connection.
        1) Depth: A minimum of 2 inches deep.
    b. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: NPS 1.

    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
    e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
10. Provide economizer with outside air and return air dampers with enthalpy controls for field installation.

## 2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Refrigerant Charge: R-410A.
    c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
    d. Provide 2-state cooling.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 0 deg F. or use economizer if on unit and delete this requirement.
7. Provide hail guards and timer for anti short cycle.

## 2.4 ACCESSORIES

A. Thermostat: seven-day programmable thermostat, low voltage with subbase to control compressor and evaporator fan.

B. Provide a CO2 sensor to control the outside air in non-economizer mode.

C. Provide humidity control to energize hot gas reheat with humidity levels exceed an adjustable high level.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

F. Drain Hose: For condensate.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units' level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on reinforced concrete with size as indicated on architectural documents. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install seismic restraints.

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

F. Install thermostat wiring from thermostat, mounted at 48" AFF coordinated with the light switch, and route wiring inside conduit system provided by Division 16.

G. Program all thermostats per the owners expected schedule. In absence of a schedule provided by the owner, program all classroom and office units to operate from 7:00am to 4:00 pm Monday through Friday. The shall be in night-setback at all other times.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 15738

# SECTION 15739 – MINI-SPLIT-SYSTEM AIR-CONDITIONING UNITS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes mini split-system air-conditioning and heat-pump units consisting of separate outdoor unit and multiple indoor units.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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.

### 1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

### 1.5 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 Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

### 1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year from date of Substantial Completion.
c. For Labor: One year 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. Daikin AC
2. LG
3. Mitsubishi
4. Sanyo

B. All manufacturers shall have a representative based in the State of Arkansas or in the City of Memphis, Tennessee. The submittal and all correspondence shall be from this office located as specified.

### 2.2 INDOOR UNITS

1. Indoor evaporators shall be equivalent to the model scheduled.

### 2.3 OUTDOOR UNITS

A. Air-Cooled, heat pump equal to Daikin AC VRV-S.
1. Hermetically sealed scroll compressor with 29% to 100% capacity control range.
2. Propeller condenser fans that are direct drive.
3. R-410a refrigerant with refrigerant piping liquid and suction lines to each piece size per manufacturer’s instructions for field conditions and lengths.
4. Provide electronic expansion valve.
5. Provide inverter driven variable speed scroll compressor with VFD controlled outdoor motor.

### 2.4 ACCESSORIES

A. Control equipment and sequence of operation are specified in Section 15900 "HVAC Instrumentation and Controls" and Section 15940 "Sequence of Operation."

B. Provide a wall mounted programmable thermostat, simple, for zone control of each evaporator.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Drain Hose: For condensate.

E. Provide condensate pumps for all units.

F. Provide condensate overflow switch.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install units' level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:
1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03300 "Cast-in-Place Concrete."
2. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 15815 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 15820 "Duct Accessories."

### 3.3 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. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

**END OF SECTION 15739**

# SECTION 15815 – METAL DUCTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:
1. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
2. Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

### 1.2 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 and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", the standards of the Memphis Area Seismic Zone, and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."]

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:
1. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

2.1 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 1-4, "Transverse (Girth) 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 1-5, "Longitudinal Seams - Rectangular Ducts," 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 2, "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 ROUND DUCTS AND FITTINGS

A. 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: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Lindab Inc.
      b. McGill AirFlow LLC.
      c. SEMCO Incorporated.
      d. Sheet Metal Connectors, Inc.
      e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," 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."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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."
   1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," 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."

2.3 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: G60.
   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. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. 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.

G. 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: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. CertainTeed Corporation; Insulation Group.
b. Johns Manville.
c. Knauf Insulation.
d. Owens Corning.
2. Maximum Thermal Conductivity:
a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
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.
a. 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).

B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
1. 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.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. 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.
8. 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:
   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. 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.

## 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: 3 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, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 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 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 Division 15 Section "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 "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 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of **12 feet** in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

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":
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. 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 4, "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. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
   1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
   2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect 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. Set anchors to manufacturer's recommended torque, using a torque wrench.
   5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 DUCT CLEANING

A. Clean new 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 Division 15 Section "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.

3.9 START UP

A. Air Balance: Comply with requirements in Division 15 Section "Testing, Adjusting, and Balancing."

3.10 DUCT SCHEDULE

A. Supply & Return Ducts:
1. Ducts Connected to Constant-Volume Rooftop-Handling Units:
a. Pressure Class: Positive 2-inch wg
b. SMACNA Leakage Class for Rectangular: 6.
c. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Equipment Not Listed Above:
a. Pressure Class: Positive 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 3.
c. SMACNA Leakage Class for Round and Flat Oval: 3.

B. 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 if negative pressure, and A if positive pressure.
   c. SMACNA Leakage Class for Rectangular: 12.
2. SMACNA Leakage Class for Round and Flat Oval: 6. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
   a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
   b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
   c. Welded seams and joints.
   d. Pressure Class: Positive or negative 2-inch wg.
   e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   f. SMACNA Leakage Class: 3.
3. Ducts Connected to Dishwasher Hoods:
   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish.
   c. Concealed: No. 2D finish.
   d. Welded seams and flanged joints with watertight EPDM gaskets.
   e. Pressure Class: Positive or negative 2-inch wg.
   f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   g. SMACNA Leakage Class: 3.
4. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
   a. Type 316, stainless-steel sheet.
      1) Exposed to View: No. 4 finish.
      2) Concealed: No. 2B finish.
   b. Pressure Class: Positive or negative 3-inch wg.
   c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   d. SMACNA Leakage Class: 3.

C. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Constant-Volume Rooftop-Handling Units:
   a. Pressure Class: Positive 2-inch wg
   b. SMACNA Leakage Class for Rectangular: 6.
   c. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Equipment Not Listed Above:
   a. Pressure Class: Positive 2-inch wg.
   b. SMACNA Leakage Class for Rectangular: 3.
   c. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel

E. Liner:
1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
4. Supply Fan Plenums: Fibrous glass, Type II, 1 inch thick.
5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 2 inches thick.
6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

F. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:
   1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
   2) Mitered Type RE 4 without vanes.
b. Velocity 1000 to 1500 fpm:
   1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
   2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
   3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
c. Velocity 1500 fpm or Higher:
   1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
3. 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) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inchesand Larger in Diameter: Standing seam or Welded.

G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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 15815**

# SECTION 15820 – DUCT ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Control dampers.
3. Fire dampers.
4. Smoke dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

B. Provide motorized control dampers on louvers as noted on plans. A motorized operator provided by this section shall control the dampers. This damper motor shall be 120-volt powered and shall remain closed when the power is on. The Division 16 contractor wires these dampers. The dampers shall fail open, spring open, when power fails to allow natural ventilation through the dampers in a power failure scenario, e.g. power failure due to a tornado will open the dampers to allow natural ventilation. The damper motors shall be equal to those described in Section 15900 HVAC Instrumentation and Controls. Note there are eight of these, two shown on plan are stacked, review elevations.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

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 and smoke-damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.3 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 MATERIALS

A. 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: G60.
2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. 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.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. McGill AirFlow LLC.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Ruskin Company.
f. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
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.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. McGill AirFlow LLC.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Ruskin Company.
    f. Vent Products Company, Inc.

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.

## 2.3 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. McGill AirFlow LLC.
    c. METALAIRE, Inc.
    d. Nailor Industries Inc.
    e. Ruskin Company.
    f. Vent Products Company, Inc.

B. Frames:
1. Galvanized-steel channels, 0.064 inch thick.
2. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Galvanized steel.
3. 0.064 inch thick.

4. Blade Edging: Closed-cell neoprene edging.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Ruskin Company.
7. Vent Products Company, Inc.

B. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.

C. Fire Rating: 1-1/2 and 3 hours.

D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 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.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. 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.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Heat-Responsive Device: Replaceable, rated, fusible links.

2.5 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. PHL, Inc.
5. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

H. Damper Motors:

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "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.
2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
3. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
4. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

## 2.6 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

## 2.7 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, 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. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.8 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - 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.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
3. Doors close when pressures are within set-point range.
4. Hinge: Continuous piano.
5. Latches: Cam.
6. Seal: Neoprene or foam rubber.
7. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

## 2.9 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

D. Minimum Pressure Rating: 10-inch wg, positive or negative.

## 2.10 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, 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 3-1/2 inches wide attached to 2 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. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor 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.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.11 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2004.

C. 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.

2.12 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 and control dampers 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 and downstream 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 and downstream from turning vanes.
9. Control devices requiring inspection.
10. 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 Division 15 Section "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 diffusers or light troffer boots to ducts directly or with maximum 36 lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

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 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.

**END OF SECTION 15820**

# SECTION 15838 – POWER VENTILATORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Ceiling-mounting ventilators.

### 1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

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.

C. Field quality-control test reports.

D. Operation and maintenance data.

### 1.3 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. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

## PART 2 - PRODUCTS

### 2.1 CEILING-MOUNTING VENTILATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carnes Company HVAC.
   2. Greenheck.
   3. Loren Cook Company.
   4. Penn Ventilation.

C. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

D. Housing: Steel, lined with acoustical insulation.

E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:
1. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
2. Motion Sensor: Motion detector with adjustable shutoff timer.
3. Filter: Washable aluminum to fit between fan and grille.
4. Isolation: Rubber-in-shear vibration isolators.
5. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.2 MOTORS

A. Comply with requirements in Division 15 Section "Motors."

B. Enclosure Type: Totally enclosed, fan cooled.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Install units with clearances for service and maintenance.

C. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

D. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

E. Install ducts adjacent to power ventilators to allow service and maintenance.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
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. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 15838**

# SECTION 15855 – DIFFUSERS, REGISTERS, AND GRILLES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Air distribution

B. Related Sections:
   1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

### 1.2 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.

## PART 2 - PRODUCTS

1. Products as scheduled on plans or equal.
2. Note that certain diffusers shall meet the suicide deterrent requirements.

## PART 3 - EXECUTION

### 3.1 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.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

**END OF SECTION 15855**

# SECTION 15950 – TESTING, ADJUSTING, AND BALANCING

## PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. 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.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## 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 systems for installed 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 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 meet the leakage class of connected ducts as specified in Division 15 Section "Metal Ducts" and 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 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 filters and verify that bearings are greased, belts are aligned and tight, 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 strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

## 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.

1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."

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. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 15 Section "HVAC 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. Crosscheck 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 Division 15 Section "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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. 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.

6. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 15 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. 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 will occur. 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 within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

## 3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

## 3.7 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. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

## 3.8 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser-water flow to each cell of the cooling tower.
2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser-water flow rate recirculating through the cooling tower.
6. Measure cooling-tower spray pump discharge pressure.

7. Adjust water level and feed rate of makeup water system.
8. Measure flow through bypass.

3.9 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor dat

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.11 TOLERANCES

A. Set HVAC system's air flow 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.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.12 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.

3.13 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.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. 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 contractor.
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. Face and bypass damper settings at coils.
e. Fan drive settings including settings and percentage of maximum pitch diameter.
f. Inlet vane 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 distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

3.14 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 15950**

# SECTION 16010 - ELECTRICAL GENERAL PROVISIONS

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 - General Requirements of the Specification, apply to the work in this Section.

B. Pre-Installation Meetings:

1. Primary: Contractor shall conduct an electrical work pre-installation meeting at project site prior to start of electrical work. Meeting shall include review of construction conditions, environmental requirements and coordination required for installation of the work. Meeting participants shall include installers of electrical work, mechanical work and related project work, and product manufacturer representatives as necessary.

2. Other Work: When required, installers of electrical work shall participate in other pre-installation meetings at project site to review conditions of other related project work. Assist in working-out conflicts, interferences, adjustment and responsibilities.

### 1.02 APPLICATION

A. Summary:

1. General: This Section specifies electrical general provisions which shall apply to the work required by Division 16 - Electrical.

2. Included: Electrical general provisions, include, but are not limited to, the following:
   a. Permits and governmental fees, licenses and inspections required for electrical work, except building permit.
   b. Materials, equipment and systems, except as otherwise required, and including but not limited to:
      1) Providing motor starters.
      2) Setting motors shipped separated or loose from equipment.
      3) Electrical system for furnishing power to illuminated architectural signage.
      4) Cathodic protection.
   c. Rough-in and connections of electrical services to interface points at line side of prewired facilities and equipment included under the Contract and provided under separate contracts.
   d. Testing, adjusting and balancing electrical work.
   e. Electrical systems which meet indicated requirements, and are complete, permanent and of safe operation.

3. Type of Work: Required types of electrical work include, but are not limited to, the following:

   a. Basic materials and methods.
   b. Service and distribution.
   c. Lighting.
   d. Special systems.
   e. Communications.
   f. Control and instrumentation associated with electrical work.

B. Related Work Specified Elsewhere:

1. Conditions of the Contract
2. Cast-in-Place Concrete Work: Setting of items to be embedded in concrete.
3. Automatic Temperature Control: Temperature control system and associated wiring.
4. All related sections 16000 (electrical) and 13000 (special systems).

C. Definitions: Definitions related to electrical work are as follows and additional definitions related to specific type electrical work are defined in respective sections of Division 16 Electrical.

1. Concealed: Hidden from sight within chases, walls, furred spaces, shafts, suspended ceilings or crawl spaces, or embedded in construction, or buried underground, in the completed project.

2. Ductwork: Ducts and associated fittings, transitions, dampers hangers, supports and like accessories related to ductwork.

3. Erect: To install.

4. Equipment: Machinery, apparatus, appliances and like items.

5. Exposed: Not concealed in completed project.

6. Install: As defined in the conditions of the Contract, and including assembling fabricated products, locating and placing work in correct position and permanently anchoring work in-place, and performing other work necessary for electrical work to be complete, permanent and of safe operation.

7. Invert Elevation: Elevation measured at bottom of underground duct.

8. Line: Piping run, ductwork run, electrical conduit run and like items as applicable.

9. Piping: Pipe and associated fittings, valves, specialties, hangers, supports and like accessories related to piping.

1.03 QUALITY ASSURANCE

A. Reference Standards: Meet requirements of the following, except to extent more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section and of governing codes and regulations:

1. ANSI - Standards and Specifications.
2. ASTM - Standards and Specifications.
3. AWS D1.1 - Structural and Specifications.
4. Local Codes and Regulations.
5. FM - Approval Guide and Loss Prevention Data Sheets.
6. IEEE - Standards and Specifications.
7. NEMA - Standards and Specifications.
8. NFPA - Standards and Specifications.
9. NFPA 101 - Life Safety Code.
10. OSHA - Safety and Health Standards, including standards for personnel protection for permanent electrical work operation.
11. UL - Standards for Safety.
12. NEC – National Electrical Code.

B. Production Qualifications:

1. General: Provide products indicated under same category produced by one manufacturer.

2. Standard Products: Insofar as possible, each product shall be a standard product of a manufacturer regularly engaged in the manufacturer of such product for minimum 5 years. Manufacturer shall perform whatever modifications or additions to such standard products required for product to meet requirements of the Contract Documents. Products shall be of current design documented by manufacturer's product data.

3. All products shall be new.

C. Installer Qualifications: Installer for each type electrical work shall have minimum 3 years experience in type work required.

D. Design Intent:

1. General: Electrical work description and requirements indicated, establish basic arrangements, dimensions, operating conditions, performance, connections of principal products and devices, and like requirements. Within these limitations, electrical work shall meet construction documents and like requirements indicated, include components not indicated but necessary for operation and performance, and shall be complete, permanent and of safe operation. Perform whatever modifications or additions to meet requirements and for installation, subject to review by the Engineer.

2. Layout:
   a. Dimensions: Dimensions on Drawings shall be verified at the project site. No requirements shall be scaled from the Drawings and used as definite dimensions for layout or fitting work in-place.
   b. No Dimensions: Electrical work not located on Drawings by dimensions shall be installed at approximate location indicated on Drawings subject to specified layout, interference and adjustment criteria. Verify locations with other trades and architectural drawings.
   c. Inadequacies: When electrical work required by a section of Division 16 - Electrical interferes with other project work, or space conditions or accessibility are inadequate for installation, operation or maintenance, notify the Engineer before starting work.
   d. Coordinate Groupings: Electrical work shall have coordinate groupings of devices, controls and like items requiring periodic adjustment, replacement or maintenance at common locations insofar as practicable and at access panels when concealed in construction, except as otherwise required.
   e. Review: Proposed modifications or additions to electrical work shall be reviewed by the Engineer before starting work. Assist in working out modifications, additions or inadequacies to provide adjustments.
   f. Non-Compliance: In event electrical work does not meet requirements indicated, including demonstrations by inspections, tests or actual operation at project site, remedy electrical work deficiencies and be responsible for resulting loss or damage.
   g. Line Right-Of-Ways: Lines whose elevations cannot be changed have right-of-way over lines not required to pitch. Large cross-sectional lines have right-of-way over lines which are not required to pitch.
   h. Clearances: Electrical work shall clear building construction, window and door components such as doors, and mechanical/ plumbing equipment. Provide electrical work with maximum headroom, unless otherwise indicated. Where insufficient space is provided, obtain clarification from the Engineer. Code clearance for maintenance for electrical equipment shall be maintained. Coordinate in field with all divisions for

necessary modifications to equipment location. Notify engineer, owner, and/or architect of needed changes.

E. Operating Conditions:

1. Motor Starters: Obtain information relative to purchase of motor starters from manufacturer or supplier of equipment requiring motor.

2. Noise Limitations: Noise, vibrations and like sounds emitted or generated by electrical work during any operation or loading condition, not exceeding rated maximum load, shall be within requirements of governing codes and regulations relating to permanent electrical work operation.

F. Access Units Fire-Resistance Ratings:

1. Where fire-resistance ratings are indicated for construction penetrated by access units, provide UL-listed and labeled units, except for units which are smaller than minimum size requiring ratings, as recognized by governing authority. Coordinate locations of all fire rating openings from Architectural drawings.

G. Concrete Work:

1. Concrete work shall be furnished by this contractor as shown on drawings, and shall include, but not be limited to:
    a. Pads for electrical indoor unit substations, switchgear, switchboards, motor control centers, and indoor floor mounted transformers.
    b. Individual Medium Voltage switches.
    c. Foundations for exterior lighting standards and block heater receptacles.
    d. Miscellaneous electrical equipment requiring concrete pads.
    e. Ductbanks.
    f. Handholes.
2. Type of concrete - refer to Section 03300 of the specification.

K. Quality Control - Products: Manufactured and fabricated electrical products are subject to inspection, factory test and project site tests. Meet requirements of Section 01070 - Quality Control.

1.04 COORDINATION

A Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. Slope connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division * Sections “Access Doors and Frames”.

D Coordinate electrical testing or electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

E Furnish to the general contractor: Bolt templates and structural support bracket and accessories for exterior, wall mounted equipment, to properly install and integrate bracket into the construction of the wall. Mounting equipment on an exterior wall solely to a flush mounted junction box is strictly prohibited.

F Changes required in electrical work due to lack of coordination shall be at no change in Contract sum.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. General: Provide electrical work which meets requirements of governing codes, regulations and standards, including regulations and standards for permanent personnel protection, permanent environmental protection, and permanent electrical work operations and functions. Applicable codes and regulations include the following:

1. National Electrical Code
2. Local Codes and Regulations
3. EPA - Regulation and Standards.
4. OSHA - Regulation and Standards.
5. UL - Listed Product with applied UL-Listing Mark.

1.06 SUBMITTALS

A. Product Listing:

1. General: Submit an itemized list of electrical work products required by each section of Division 16 - Electrical proposed for the work. Furnish list with required information typewritten on 8-1/2 inch by 11 inch Contractor's stationary. Meet applicable requirements of Section 01040 - Submittals and additional requirements of this Paragraph.

2. Products Required: Submit product listing for the following, in addition to product listings required by other sections of Division 16 - Electrical:

| | | |
|---|---|---|
| a. | Conduit | Type and Manufacturer |
| b. | Conduit Fittings | Type and Manufacturer |
| c. | Outlet Boxes | Manufacturer |
| d. | Wire and Cable | Type and Manufacturer |
| e. | Transformers, Dry | Type Manufacturer |
| f. | Switchgear | Type and Manufacturer |
| g. | Panelboards | Manufacturer |
| h. | Cable Trays | Manufacturer |
| i. | Contactors | Manufacturer and Catalog Number |
| j. | Wiring Devices | Manufacturer and Catalog Number |
| k. | Lighting Fixtures | Type, Manufacturer and Catalog Number |
| l. | Fire Alarm System | Manufacturer and Catalog Cuts |
| m. | Manhole & Handhole | Manufacturer and Catalog Cuts |
| n. | Lighting Controls | Manufacturer and Catalog Cuts |
| o. | Timers | Manufacturer and Catalog Cuts |
| p. | Cathodic Protection | Manufacturer and Catalog Cuts |
| q. | Generator and ATS | Manufacturer and Catalog Cuts |

B. Product Data:

1. General: Submit manufacturer's specifications, recommendations and installation instructions for electrical work products required by each section of Division 16 - Electrical. Include manufacturer's published data or certified laboratory test data indicating that each electrical work product meets the specified requirements. Meet requirements of Section 01040 - Submittals and additional requirements of this Paragraph.

2. Data Included: Product data shall include the following as applicable:

   a. Product name and model or catalog designation, and manufacturer's name.
   b. Physical description, dimensions and weights.
   c. Data for coordination with other electrical and project work.
   d. Clear spaces required for handling, installing, operating and maintaining products.
   e. Required installation clearances and tolerances.
   f. Applicable reference standard designations.
   g. Properties, characteristics, capabilities and limitations.
   h. Product specifications, including protective coatings.
   i. Methods and details for anchorage to supporting construction.
   j. Data which affects design and construction of supporting structure, including maximum reactions imposed on supporting structures at each connection or bearing point.
   k. Diagrams of wiring arrangement, actual arrangement of external connections as seen by installer and terminal identification designation on actual product.
   l. Diagrams for operation and control of work, including location and function of instrumentation and control devices.

3. Certification: When required, product data shall be certified by product manufacturer.

C. Shop Drawings:

1. General: Submit shop drawings for electrical work required by each section of Division 16 - Electrical. Meet requirements of Section 01040 - Submittals and additional requirements of this Paragraph.

2. Presentation: Shop drawings shall indicate plan view layout of electrical work. Shop drawings indicating electrical work associated with equipment rooms or congested areas shall be drawn at minimum scale of 1/4 inch equals 1'-0". When necessary for clarity and in congested areas, shop drawings shall include sections drawn at 1/4 inch equals 1'-0".

3. Data Included: Shop drawings shall include the following as applicable:

   a. General arrangement, layout of work, physical descriptions, dimensions and weights.
   b. Amplified details in relation to the work and project, details and dimensions for locating work, and required installation clearances and tolerances.
   c. Location and sizes of openings and sleeves required in building construction of passage of electrical work, and information necessary to coordinate and permit installation of work.
   d. Clear spaces required for handling, installing, operating and maintaining work.
   e. Project site assembly of work furnished in two or more components and weight of each component.
   f. Applicable reference standard designations.
   g. Properties, characteristics, capabilities and limitations.
   h. Design and actual details of manufacture or fabrication, including material specifications and dimensions, joining methods and protective coatings.

i. Methods and details for anchorage to supporting structures.
j. Data which affects design and construction of supporting structures, including maximum reactions imposed on supporting structures at each connection or bearing point.
k. Diagrams of wiring arrangement, actual arrangement of external connections as seen by installer and terminal identification designations indicated on actual work.
l. Diagrams for operation and control of work, including location and function of instrumentation and control devices.

4. Certification: When required, shop drawings shall be certified by originator of work covered by shop drawings.

5. Drawings required: Submit shop drawings for the following, in addition to shop drawings required by other sections of Division 16 - Electrical:

a. Switchgear.
b. Motor Control Centers
c. Unit substations.
d. Lighting fixtures, special or custom built - mounting arrangements.
e. Fire Alarm Systems

D. Operating and Maintenance Data: Submit operating and maintenance data, including instructions, schedules and parts lists, for electrical work.

E. Maintenance products:

1. General: Furnish maintenance products and like items for electrical work required by each section of Division 16 - Electrical. Meet requirements of Section 01080 - O&M Manuals Instructions & Training and additional requirements of this Paragraph.

2. Delivery: Deliver Maintenance products to owner at project site at completion of the work, and unload and place in storage as directed by owner.

3. Maintenance products required: Furnish following maintenance products, in addition to maintenance products required by other section of Division 16 - Electrical:
a. Special Tools: Two each of special tools required for servicing electrical work, except as otherwise required.
b. Touch-up Finish Paint: When major products are required to be factory finished, furnish one quart of each type and color finish coat paint applied to product for field touch-up.

F. Record Documents: Submit record documents of electrical work at completion of the work.

1.07 PRODUCT HANDLING, DELIVERY AND STORAGE

A. General: Deliver, store, handle and protect products prior to and during installation.

B. Delivery: Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.

2. Fed. Spec. number, if applicable.

3. Manufacturer's stock number and date of manufacture.

4. Manufacturer's name.

5. Contents by volume.

6. Application instructions.

7. Color name and number.

C. Storage: Store materials not in actual use in covered containers. Keep storage area neat and orderly.

1.08 JOB CONDITIONS

A. Manufacturer's Representative: Furnish installation assistance services of product manufacturer's factory trained representative to give product preparation and installation instructions, assist in product start-up operations, direct acceptance inspections and tests, and perform like services at project site as required.

B. Structural Components: Do not cut, drill or weld building structural components for attachment of electrical work without prior review by the Engineer of each condition, except where specifically indicated. Requests for authorization shall be in writing, designating specific extent and limits of work and components proposed to be cut, drilled or welded.

C. Fireproofing: Do not cut or remove fireproofing materials which protect or cover construction without prior review by Architect of each condition. Requests for authorization shall be in writing designating specific extent and limits of fireproofing proposed to be cut or removed. Removed fireproofing materials shall be replaced meeting requirements for original installation.

D. Protection:

1. General: Provide and maintain temporary protection for electrical work, and surrounding areas and surfaces to preclude damage during installation of electrical work.

2. Line and Product Openings: Prevent entrance of foreign material into lines and products. Protect openings by use of plugs, caps or like devices.

3. Appliances: Protect appliances, fixtures and like apparatus from dirt, chemical damage and mechanical damage.

1.09 OPERATING AND MAINTENANCE DEMONSTRATIONS

A. General: Provide instructions and demonstrations to designated operating personnel covering operation, adjustment and maintenance of electrical work.

B. Coverage: Operating personnel shall be presented with material for them to gain a thorough knowledge and understanding of the electrical work. Instructions and demonstrations shall include electrical work requirements, manufacturer's instructions and all phases of safe operation, control, adjustments and maintenance.

C. Instructor Qualifications: Instructors shall be technicians competent in operating, adjustment and maintenance of each type electrical work. When required, furnish product manufacturer's representative to provide instructions and demonstrations. Meet requirements of Article 1.08 - Job Conditions of this Section.

D. Service: Furnish product manufacturer's factory trained representative to provide instructions and demonstrations when required by each section of Division 16 - Electrical, recommended by product manufacturer, required by installer, necessitated by project site conditions or product manufacturer warranty is contingent upon such service.

1.10 WARRANTY

A. General: Warranty electrical work meeting provisions of the Conditions of the Contract, except warranty shall include the additional provisions of this Article.

B. Warranty shall extend to corrections of the work found to be defective or nonconforming to the Contract Documents at no change in Contract Sum. Included shall be correction of all damages resulting from such defects or nonconformance with Contract Documents, exclusive of repairs required or as result of improper maintenance or operation, or of normal wear. Corrective work shall be performed by original installer. Warranty shall be signed by the Contractor and installer.

C. Time Period: Repairs or replacements made to electrical work within the warranty time period shall be, in addition, warranted for one year from date of final acceptance of each repair or replacement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Protective Coatings:

1. Metal Prime Paint:

a. Performance: FS TT-P-86, Type II.
b. Acceptable Products: Subject to meeting requirements, products which may be incorporated in the work include the following:

1) The Detroit Graphite Company, 501 Prime/Rite.
2) E.I. DuPont DeNamours & Company, Inc., 373-Y-851 Rust Resistant Metal Primer.
3) Tnemec Company, Inc., 10-99 Red Tnemec Primer.

2. Metal Finish Paint: Product Manufacturer's Standard machinery finish-coat paint material for electrical work service. Finish color shall be selected by FedEx from manufacturer's standard colors, except as otherwise required.

3. Galvanize Repair Paint:

a. Description: High zinc-dust content coating material for repair or touch-up of damaged galvanized surfaces, MIL-P-21035.
b. Acceptable Products: Subject to meeting requirements, products which may be incorporated into work include following:
1) ZRC Chemical Products Co., Z.R.C. Cold Galvanized Compound.

4. Touch-Up Paint: Same type coating materials and compatible with existing coating system. Color of finish-coat paint shall match existing.

5. Rust Preventative: Durable rust preventative materials which after application is easily removed and non-defacing.

6. Available Manufacturers:

    a. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
        1) Devoe and Reynolds Co. (Devoe).
        2) Glidden Coatings and Resins, Division of SCM Corporation (Glidden).
        3) Benjamin Moore and Co. (Moore).

2.02 FABRICATION

A. Fabricate electrical work meeting requirements of the Contract Documents, product manufacturer's instructions, recommended tolerances and recommended procedures, and as indicated by final reviewed submittals for the work.

B. Workmanship: Use materials of size and thickness indicated. If not indicated, select size and thickness to provide strength and durability in finished work for intended application and as required by Code. Work to dimensions indicated, using proven fabrication details.

C. Finish

1. Product surfaces and edges shall be smooth and free of marks, burrs, seams, roughness and like defects or conditions.
2. Welds: When required, grind welds flush and uniform with parent metal surfaces, and finish welds to match parent metal. Remove flux, oxide, splatter and like residue from welds and adjacent areas on product exterior and interior surfaces.
3. Synthetic Fillers: Synthetic type filler putty materials for use as a metal filler is not acceptable.

1.03 PROTECTIVE COATINGS

A. Prime paint metal products after fabrication and before delivery to project site, except as otherwise required.

1. Painting work inside building will be done under Division 9 - Finishes of this specification.

1.04 CLEAN-UP AND PROTECTION

A. During progress of work, remove from site discarded materials, rubbish, cans and rags at end of each work day.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas drawings, and conditions under which electrical work is to be installed or performed, and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install electrical work meeting requirements of the Contract Documents, product manufacturer's instructions, recommended tolerances and recommended procedures, and as indicated by final reviewed submittals for the work.

## B. Cutting and Patching

1. Cut and patch if required the new construction to accommodate new electrical work.

2. Openings: Whenever possible, openings in new concrete or masonry construction shall be boxed out instead of core drilled.

3. Prohibition: This Contractor shall not cut, penetrate, or otherwise alter the conveyor ball mat or roller deck without written approval from FedEx.

## C. Access to Electrical Work

1. Install access units where indicated, in accordance with manufacturer's written instructions, in compliance with NEC, and with recognized industry practices.

2. Coordinate with other work, including substrate construction work, as necessary to interface installation of access units with other work.

3. Locate each removable access unit accurately in relation to electrical work requiring access.

4. Provide adequate temporary support or attachment to framing or formwork, such that units will not be dislocated during construction of substrates.

5. Set frames accurately in position and securely attached to supports with face panels plumb or level in relation to adjacent finish surfaces.

6. Adjust hardware and panels after installation for proper operation.

7. Remove and replace panels or frames which are warped, bowed, or damaged.

## D. Excavating and Electrical Work

1. Do not excavate for electrical work until the work is ready to proceed without delay, so that time lapse from excavation to completion of backfilling will be minimized.

2. Excavate with vertical-sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides or excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.

3. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate bottom cut to accurate elevations. Except as otherwise indicated, support the following work on undisturbed soil at bottom of excavations:

    a. Single conduit of 5" and less nominal size.
    b. Cast-in-place concrete.
    c. Flat-bottomed multiple-duct conduit units.

4. Depth for Subbase Support: Where installation of subbase material is indicated, excavate for installation of subbase material in depth indicated or, if not otherwise indicated, 6" below bottom of work to be supported.

5. Shoring and Bracing: Provide materials for shoring and bracing, such as sheeting piling, uprights, stringers and cross-braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

6. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

7. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.

8. Excavate trenches to depth indicated or required. Carry depth of elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.

9. For pipes or conduit 5" or less in nominal size do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

10. For handholes, excavate to subbase depth indicated, or, if not otherwise indicated, to 6" below bottom of work to be supported.

11. Grade bottoms trenches as indicated, notching under conduit couplings to provide solid bearing for entire body of conduit.

12. Depth for Unsatisfactory Soil Conditions: Where directed (because of unsatisfactory soil condition at bottom of indicated excavation), excavate additional depth as directed by the Engineer to reach satisfactory soil-bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth.

13. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

    a. Retain excavated material which complies with requirements for backfill material.
    b. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfilling material.
        1. Remove unused material from project side, and dispose of in lawful manner.

## E. Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

3. Maintain dry excavations for electrical work by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations below-grade property from being damaged by water, sediment or erosion from or through electrical work excavations.

a. Install and operate well-point dewatering system to maintain ground water at level approximately 2'-0" below electrical work excavations, until backfilling is completed.

4. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).

## F. Manholes and Handholes Installation

1. Subbase Installations: Where indicated, install subbase material to receive electrical work, and compact by tamping to form a firm base for the work. For horizontal cylindrical work, shape subbase to fit shape of bottom 90 deg of cylinder, for uniform continuous support.

   a. Provide finely-graded subbase material for wrapped, coated and plastic materials to be buried.

2. Install drainage fill where indicated, and tamp to uniform firm density.

## G. Backfilling

1. Except as otherwise indicated, backfill with properly qualified backfill material.

2. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic materials.

3. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

4. Backfill simultaneously on opposite sides of electrical work, and compact simultaneously; do not dislocate the work from installed positions.
5. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.

   a. Lawn/Landscaped Areas: 85% for cohesive soils; 90% for cohesionless soils.
   b. Paved Areas, Other Than Roadways: 90% for cohesive soils; 95% for cohesionless soils.
   c. Roadways: 90% for cohesive soils; 95% for cohesionless soils.

6. Backfill to elevations matching adjacent grades at time of backfilling excavations for electrical work.

7. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Engineer. Use care in backfilling to avoid damage or displacement of conduit/pipe systems.

8. Coordinate compaction requirements with Section 02200 - Earthwork Standards.

## H. Miscellaneous Concrete Work

1. Concrete Grouting: Grout openings and recesses as indicated, in and around electrical work and other work which penetrates or adjoins electrical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.

2. Refer to individual sections of these specifications for fine-grouting of base plates on foundations (usually with non-shrinking grout), and similar grouting requirements not defined herein as concrete work.

END OF SECTION

# SECTION 16060 - GROUNDING AND BONDING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.4 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 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. ILSCO.
4. O-Z/Gedney; A Brand of the EGS Electrical Group.
5. Robbins Lightning, Inc.

2.2 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 UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

B. 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.

2.4 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 compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 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

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

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 Ground Rods at Test Wells: Bolted connectors.
4. 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 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Transformer: Install grounding electrode and conductors at transformer connected as required per NEC 250.

## 3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

## 3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. 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.

C. 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.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.6 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. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building's foundation.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.7 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, and 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.

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 Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

END OF SECTION 16060

# SECTION 16073 - 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. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Section 16074 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

### 1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

### 1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07720 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, 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. Thomas & Betts Corporation.
e. Unistrut; Tyco International, Ltd.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored 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 malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) 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 in which used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) 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 similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.2 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 05500 "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 except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other 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 .

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-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, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in 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: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
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 reinforcing bars.

## 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05500 "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 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03300 "Cast-In-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

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 minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 09911 "Exterior Painting" 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 16073

# SECTION 16075 - ELECTRICAL IDENTIFICATION

## 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. Underground-line warning tape.
2. Warning labels and signs.
3. Instruction signs.
4. Equipment identification labels.
5. Miscellaneous identification products.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

### 1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

### 1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

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.

2.2 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.

2.3 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

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.

## 2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 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. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. 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 exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with permanent marker labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Panel name and circuits concealed.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor insulation 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
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

C. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.

D. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

E. 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.

F. 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.

G. 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 equipment in finished spaces.

H. 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.

I. 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.

J. 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, 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: Engraved, laminated acrylic or melamine label. 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.
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: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label. Label tag designation shown on drawings and feeder panelboard.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchboards.
e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
f. Enclosed switches.
g. Enclosed circuit breakers.
h. Enclosed controllers.
i. Variable-speed controllers.
j. Push-button stations.
k. Contactors.
l. Remote-controlled switches, dimmer modules, and control devices.
m. Monitoring and control equipment.
n. Receptacles with panel and circuit number.

END OF SECTION 16075

# SECTION 16091 - 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 07841 "Through-Penetration Firestop Systems" 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.

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. 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: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Presealed Systems.

## 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 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 07920 "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.

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 16091

# SECTION 16120 - 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 QUALITY ASSURANCE

A. Comply with the NEC as applicable to construction and installation of electrical wire, cable, and connectors.

B. Comply with UL standards pertaining to building wire and connectors.

C. Provide electrical wire, cables, and connectors which have been UL listed and labeled.

D. Comply with applicable portions of ANSI/ASTM standards pertaining to construction of insulated electrical wire and cable.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable wood reels, where applicable; and weather resistant fiberboard containers for factory packaging of cable, wire and connectors, to protect against physical damage in transit. Damaged cable, wire or connectors shall be removed from project site.

B. Store cable, wire and connectors in a clean, dry indoor space in their factory-furnished coverings, which provides protection against the weather.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. General Cable Technologies Corporation.
3. Southwire Incorporated.
4. The Okonite Company

C. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

D. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. Ilsco; a branch of Bardes Corporation.
4. O-Z/Gedney; a brand of the EGS Electrical Group.
5. 3M; Electrical Markets Division.
6. Tyco Electronics.
7. WAGO

C. 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.

C. Minimum size branch circuit conductor shall be No. 12 AWG.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

G. Branch circuits for motors, as indicated on the drawings, are approximate size only. This Contractor is cautioned to obtain the exact rating of the motor operated equipment from the Mechanical Contractor, and he shall adjust the size of the protective device and wire to the equipment. All such changes shall be submitted to the Engineer for approval. Adjustment in cost to the Owner will be considered only if adjustment is greater than two (2) conductor sizes as defined by the NEC.

H. Increase branch circuit conductors in size where necessary to compensate for voltage drop, in accordance with NEC requirements.

I. All conductors shall be continuous from outlet to outlet or from panel to outlet or device. No splices will be permitted in conduit runs.

3.3 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.

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.

3.4 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 16075 "Electrical Identification."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

## 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 16091 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

## 3.6 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 07841 "Through-Penetration Firestop Systems."

## 3.7 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 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.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 16120

# SECTION 16130 - RACEWAYS AND BOXES

## 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.

B. Related Requirements:

1. Section 02584 "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
2. Section 16711 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 16712 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

### 1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

D. EMT: Electrical metallic tubing.

### 1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

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. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. O-Z/Gedney; a brand of EGS Electrical Group.
3. Republic Conduit.
4. Robroy Industries.
5. Thomas & Betts Corporation.
6. Western Tube and Conduit Corporation.
7. Wheatland Tube Company; a division of John Maneely Company.

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. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

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. Fittings for EMT:
   a. Material: Steel.
   b. Type: compression.

2. 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.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC or 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. Anamet Electrical, Inc.
2. CANTEX Inc.
3. Condux International, Inc.
4. Electri-Flex Company.
5. Kraloy.
6. Lamson & Sessions; Carlon Electrical Products.
7. Niedax-Kleinhuis USA, Inc.
8. RACO; a Hubbell company.
9. 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-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. 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; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 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: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.

4. Hoffman; a Pentair company.
5. Hubbell Incorporated; Killark Division.
6. Kraloy.
7. Mono-Systems, Inc.
8. O-Z/Gedney; a brand of EGS Electrical Group.
9. RACO; a Hubbell Company.
10. Robroy Industries.
11. Spring City Electrical Manufacturing Company.
12. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
13. Thomas & Betts Corporation.
14. Wiremold / Legrand.

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, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. 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.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel 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.

## 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 when concrete encased, Type EPC-80-PVC when direct buried.
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.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Damp or Wet Locations: GRC.
6. 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: 3/4-inch trade size and 1-inch trade size when below grade

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 compression, 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 surface raceways only where indicated on Drawings.

F. 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 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 16073 "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 are not permitted to be embedded in slabs.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC 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. 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.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. 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.

P. 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.

Q. 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.

R. 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 and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

S. 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.

## 3.3 INSTALLATION OF BOXES

A. 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.

B. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

C. Locate boxes so that cover or plate will not span different building finishes.

D. 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.

E. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

F. Set metal floor boxes level and flush with finished floor surface.

G. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

H. For exposed work, use cast metal boxes with screw hubs for all branch circuit outlet, device and pull boxes.

I. 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.

J. All outlet boxes in or on ceiling shall be supported from the tee bar or ceiling support member with a hangar designed for this purpose that secures it to the tee bar or ceiling support. Neither the box nor the device attached to the box shall be supported by the ceiling material, except for wireless lighting control devices. The hangar shall be secured to the tee bar or ceiling support with a screw run through the vertical part of the tee bar or support and hanger at each point at which it is attached.

K. Where multiple feeders are located in the same general area, each feeder shall be provided with separate junction box or pull boxes. The practice of combining several feeders in a common pull box or junction box will not be permitted. Where parallel conductors are used on the same feeder circuit, they may be combined with a common pull box, or junction box.

## 3.4 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 Section 02300 "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in "Earthwork." Section
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 "Earthwork." Section
4. Option 1: 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. Option 2: Install manufactured PVC-coated 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. Underground Warning Tape: Comply with requirements in Section 16075 "Electrical Identification."
7. Install conduits outside of building lines at a minimum depth of 30 inches below finished grade. Maintain 12 inches earth or 3 inches concrete separation between electrical conduits and other services or utilities underground. Encase all plastic service entrance conduits with concrete unless otherwise specifically detailed or noted on the drawings.

## 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 16091 "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 07841 "Through-Penetration Firestop Systems."

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 16130

# SECTION 16140 - 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. Twist-locking receptacles.
3. Receptacles with integral surge-suppression units.
4. Isolated-ground receptacles.
5. Hospital-grade receptacles.
6. Tamper-resistant receptacles.
7. Weather-resistant receptacles.
8. Snap switches and wall-box dimmers.
9. Solid-state fan speed controls.
10. Wall-switch and exterior occupancy sensors.
11. Communications outlets.
12. Pendant cord-connector devices.
13. Cord and plug sets.
14. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

### 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.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

### 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 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; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

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.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-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:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; GFTR20.
b. Pass & Seymour; 2095TR.

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5362BLS.
b. Hubbell; HBL5362SA.
c. Leviton; 5380.
d. Pass & Seymour; 5362BLSP.

2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.

## 2.6 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; CWL520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

## 2.7 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:
a) Cooper; AH1221.
b) Hubbell; HBL1221.
c) Leviton; 1221-2.
d) Pass & Seymour; CSB20AC1.

2) Two Pole:
a) Cooper; AH1222.
b) Hubbell; HBL1222.
c) Leviton; 1222-2.
d) Pass & Seymour; CSB20AC2.

3) Three Way:
a) Cooper; AH1223.
b) Hubbell; HBL1223.
c) Leviton; 1223-2.
d) Pass & Seymour; CSB20AC3.

4) Four Way:
a) Cooper; AH1224.
b) Hubbell; HBL1224.
c) Leviton; 1224-2.
d) Pass & Seymour; CSB20AC4.

C. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.

c. Leviton; 1257.
d. Pass & Seymour; 1251.

2.8 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Galvanized steel.
4. 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.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, above-floor, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Blank cover with bushed cable opening

2.10 FINISHES

A. Device Color:

1. Wiring Devices As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. TVSS Devices: Blue.

B. Wall Plate Color: For plastic covers, match device color.

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 (152 mm) 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 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. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. 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.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

## 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 16075 "Electrical Identification."

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:

1. Test Instruments: Use instruments that comply with UL 1436.

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. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 16140

# SECTION 16145 - LIGHTING CONTROL 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. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching controls.
4. Indoor occupancy sensors.
5. Outdoor motion sensors.
6. Lighting contactors.
7. Emergency shunt relays.

B. Related Requirements:

1. Section 16140 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. 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 each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Lutron Electronics Co. Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.

C. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. Lutron Electronics Co., Inc.
7. Sensor Switch, Inc.
8. Watt Stopper.

C. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

4. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.

D. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

## 2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. Lutron Electronics Co., Inc.
7. Sensor Switch, Inc.
8. Watt Stopper.

C. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

D. Wall-Switch Sensor Tag OS:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: PIR.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Dual voltage, 120 and 277 V; passive-infrared type.

5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 16120 "Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 16120 "Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 16120 "Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 16120 "Conductors and Cables." Minimum conduit size is 3/4 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 16075 "Electrical Identification."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Lighting control devices will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative if needed to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 16145

# SECTION 16289 - SURGE PROTECTIVE DEVICE

## 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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:

1. Section 16441 "Switchboards" for factory-installed SPDs.
2. Section 16442 "Panelboards" for factory-installed SPDs.

### 1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

### 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.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with 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. Comply with UL 1449 Third Edition.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE AND PANEL SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Corporation.
2. Schneider Electric Industries SAS.
3. Current Technologies.

C. SPDs: Comply with UL 1449, Type 2.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Comply with UL 1283.

F. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 400 V for 208Y/120 V.
2. Line to Ground: 400 V for 208Y/120 V.
3. Neutral to Ground: 400 V for 208Y/120 V.
4. Line to Line: 400 V for 208Y/120 V

G. SCCR: Equal or exceed 200 kA.

H. Inominal Rating: 20 kA.

EXECUTION

2.3 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs direct attached to bus from manufacturer per UL requirements on panels as indicated on riser diagram.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

2.4 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

2.5 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 16289

# SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## 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. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

### 1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

### 1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

### 1.5 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).

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. 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.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. 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.

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 NFPA 70.

1.8 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 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. 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. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

## 2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 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.

D. 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. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. 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.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. 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.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. 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.

I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

K. 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.

## 2.4 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

D. 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.

## 2.5 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.
3. Kitchen Areas: NEMA 250, Type 4X,.
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.

# 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 16074 "Vibration and 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 16075 "Electrical Identification."

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. Acceptance Testing:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 16410

# SECTION 16442 - 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.
3. Electronic-grade panelboards.

### 1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge protective device.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge protective device, accessory, and component indicated. 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. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Panelboard Schedules: For installation in panelboards.

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 01782 "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 Ground Fault Equipment Protection (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.
4. Fuses for Fused Power-Circuit Devices: 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. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

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.

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 PROJECT 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 minus 22 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 two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's written permission.
3. Comply with NFPA 70E.

## 1.11 COORDINATION

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. 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.

## 1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace surge protective devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 16074 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted 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.
    c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gauge and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. 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.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device. Provide as noted on plans.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device. Provide as noted on plans.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

E. Mains: Circuit breaker or Main Lugs only.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

H. Branch Overcurrent Protective Devices: Fused switches.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. 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.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
    h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 16491 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.

## 2.6 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. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 03300 "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 full perimeter of base.
2. For panelboards, 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 panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Section 16074 "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub three 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub three 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16075 "Electrical Identification."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16075 "Electrical Identification."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 16075 "Electrical Identification."

## 3.4 FIELD QUALITY CONTROL

A. Acceptance Testing:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. 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.

## 3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

## 3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 16442

# SECTION 16460 - TRANSFORMERS

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to work of this Section.

B. Section 16010 – Electrical General Provisions

### 1.02 APPLICATION

A. Drawings and specifications establish the extent of transformer work.

B. Types of transformers specified in this section include the following:

1. Dry-type transformers individually mounted.

C. Electrical wiring connections for transformers are specified in applicable Division-16 sections.

### 1.03 QUALITY ASSURANCE

A. Acceptable Manufacturers: Firms regularly engaged in manufacture of power/distribution transformers of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with electric power/ distribution transformer work similar to that required for this project.

C. Code Compliance: Comply with requirements as applicable to installation and construction of electrical power/distribution transformers.

D. NEMA Compliance: Comply with applicable portions of NEMA Std Pub Nos. TR 1 and TR 27 pertaining to power/distribution transformers.

E. ANSI Compliance: Comply with applicable ANSI standards pertaining to power/distribution transformers.

F. ANSI/IEEE Compliance: Comply with applicable ANSI/IEEE standards pertaining to power/distribution transformers.

G. ANSI/NEMA Compliance: Comply with NEMA Std ST 20; "Dry-Type Transformers for General Applications".

H. ANSI/UL Compliance: Comply with applicable portions of ANSI/UL 506; "Safety Standard for Specialty Transformers".

I. UL Labels: Provide distribution transformers which have been UL- listed and labeled.

### 1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data including rated KVA, frequency, primary and secondary voltages, percent taps, polarity, impedance and certification of transformer performance efficiency at indicated loads, percentage regulation at 100 percent and 80 percent power factor, no-load and full-load losses in watts, percent impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data.

B. Shop Drawings: Submit manufacturer's drawings indicating dimensions, and weight loadings for transformer installations, showing layout, mountings and supports, spatial relationship to associated equipment and panel boards, and transformer connections to electrical equipment.

C. Wiring Diagrams: Submit wiring protection and control diagrams for power distribution transformers. Clearly differentiate between portions of wiring that are manufacturer-installed and portions to be field-installed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work:

1. Cutler-Hammer
2. General Electric Company
3. Square D Company
4. Powersmiths

2.02 POWER/DISTRIBUTION TRANSFORMERS

A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. Dry-Type Distribution Transformers: Provide factory-assembled, energy efficient, general purpose, air-cooled, dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated, three-phase; 60-hertz, 30 kV BIL, 4.0 percent impedance with 480-volts delta connection primary and 208/120 volts secondary wye connected. Provide primary winding with 4 - 2 ½ percent taps two above and two below rated voltage. Insulate with Class 80 insulation and rate for continuous operation at rated KVA. Limit transformer surface temperature rise to maximum of 80 degrees C. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections and electrical supply raceway terminal connector. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 75 degrees C when transformer is operating continuously at rated load with ambient temperature of 40 degrees C. Provide wiring connectors suitable for copper wiring only. Cushion-mount transformers with external vibration isolation supports; sound-level ratings of 3 db below NEMA ST-20 tables. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully-enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide wall mount brackets when indicated on the Drawings.

C. Isolation Dry-Type Transformers: Match characteristics noted above with additional construction of mesh grounding for isolation grounding.

D. Equipment/System Identification: Provide equipment/system identification name plates complying with Division-16 Basic Materials and Methods Section "Electrical Identification" in accordance with the following listing:

1. Equipment/System Identification.

E. Finish: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

PART 3 - EXECUTION

3.01 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Install units on vibration mounts as shown; comply with manufacturer's indicated installation method if any.

D. Connect transformer units to electrical wiring system; comply with requirements of other Division-16 sections.

E. Transformers rated 75 KVA and below shall be connected to electrical wiring system using flexible conduits.

F. Floor mounted transformers shall be installed on four (4) inch thick reinforced concrete house-keeping pad, four (4) inches larger on each side than base of transformers. The pad shall be level.

3.02 GROUNDING

A. Provide equipment flexible conduit grounding connections, sufficiently tight to assure permanent and effective ground, for transformers as indicated.

3.03 TESTING

A. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION

# SECTION 16491 - 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 enclosed switches enclosed controllers motor-control centers.
2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches and fuseholders.
3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.
4. Spare-fuse cabinets.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, 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 on translucent log-log graph paper.
5. Coordination charts and tables and related data.

### 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 01782 "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. Submit on translucent log-log graph paper.
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 two of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

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. Comply with UL 248-11 for plug fuses.

1.7 PROJECT 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.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 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. Service Entrance: Class L, fast acting Class RK1, fast acting Class J, fast acting.

2. Feeders: Class L, fast acting Class RK1, fast acting Class RK5, fast acting.
3. Motor Branch Circuits: Class RK1 Class RK5, time delay.
4. Other Branch Circuits: Class RK1, time delay Class RK5, time delay Class J, fast acting Class J, time delay.
5. Control Circuits: Class CC, fast acting.

B. Plug Fuses:

1. Motor Branch Circuits: Edison-base type, dual Type S, dual-element time delay.
2. Other Branch Circuits: Edison-base type, single-element fast acting Edison-base type, dual-element time delay.

## 3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

## 3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 16075 "Electrical Identification" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 16491

# SECTION 16511 - 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 lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Section 16145 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 16140 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

### 1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LER: Luminaire efficacy rating.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Energy-efficiency data.
4. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 15855 "Diffusers, Registers, and Grilles."

5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

B. Shop Drawings: For nonstandard or custom lighting fixtures. 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. Installation instructions.

1.5 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. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

7. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 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. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

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.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. 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. Subparagraphs below are examples only. Verify available warranties and warranty periods for units and components and insert number below. Coordinate with "Emergency Lighting Units" Article.

   1. 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 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. LED Fixtures: Comply with UL 8750, IESNA LM79/80, and TM21-11.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. 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.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

G. Factory-Applied Labels: Comply with UL 1598. 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 and ballast characteristics:
   a. CCT and CRI for all luminaires.
   b. Model number from manufacturer.

2.3 GENERAL REQUIREMENTS FOR LED FIXTURE COMPONENTS

A. Comply with ANSI C78.377-2011, cULus 1598 and 2043, and UL 8750 classifications for LED fixture components. Include the following features unless otherwise indicated:

1. Driver: Universal voltage 120-277 range, electronic type, 0-10V dimming standard unless indicated otherwise on fixture schedule.
2. Listed Operating Temperature: 25 deg C.

B. Fixtures shall be IC rated. ROHS Compliant and DesignLights Consortium Qualified.

C. Fixture tested to comply with LM79/LM80. TM21-11 test data shall be available by manufacturer for engineer's review upon request and shall be for 10,000 hour test for estimated life at 60,000 hours.

D. Warranty shall be complete assembly coverage by manufacturer. Individual components shall not be sourced back to component manufacturer. Fixture supplier shall warrant all components completely.

E. System components shall be quick-connect or lug terminal connected. Wire-nuts internal to fixture will not be permitted for making connections to fixture components.

F. LED chip-set shall be CCT and CRI as noted on schedule.

2.4 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: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.
b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. 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.

3. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in battery for power connection to remote unit.
b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. 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.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

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.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 16073 "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 same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures 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 lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

F. Connect wiring according to Section 16120 "Conductors and Cables."

## 3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 16075 "Electrical Identification."

## 3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

## 3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 16511

# SECTION 16521 - 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 luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections:

1. Section 16511 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

### 1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. LED: Light emitting diode.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

### 1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factors: 1.0.

1.5 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.
11. Manufactured pole foundations.

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. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles 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. Quantities indicated in subparagraphs below are examples only.

1. Glass 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.
2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are 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.

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 IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. 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.

L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind

welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by architect from manufacturer's standard catalog of colors.

M. 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.

    a. Color: Dark Bronze.

## 2.3 GENERAL REQUIREMENTS FOR LED FIXTURE COMPONENTS

A. Comply with ANSI C78.377-2011 and UL 8750 classifications for LED fixture components. Include the following features unless otherwise indicated:

1. Driver: Universal voltage 120-277 range, electronic type.
2. Minimum Operating Temperature: Minus 40 deg C.
3. Maximum Operating Temperature: 40 deg C.
4. Transient-Voltage Protection: Comply with IEEE C62.41.1, IEEE C62.41.2, and IEEE 1449 3rd Edition Category A or better.

B. Housings shall be IP66 rated without lens on LED chip-set modules and UL Wet Location Listed. 3G vibration tested and DesignLights Consortium Qualified.

C. Fixture tested to comply with LM79/LM80. TM21-11 test data shall be available by manufacturer for engineer’s review upon request and shall be for 10,000 hour test for estimated life at 60,000 hours.

D. Warranty shall be complete assembly coverage by manufacturer. Individual components shall not be sourced back to component manufacturer. Fixture supplier shall warrant all components completely.

E. System components shall be quick-connect or lug terminal connected. Wire-nuts internal to fixture will not be permitted for making connections to fixture components.

F. LED chip-set shall be 4000K CCT with a minimum of 70CRI.

## 2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws. Provide on all, except wood poles.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03300 "Cast-In-Place Concrete."

## 2.5 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Steps: Fixed steel, with nonslip treads, positioned for 15-inch vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet above finished grade.

E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 16060 "Grounding and Bonding," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected by Architect from manufacturer's full range.

## 2.6 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

# PART 3 - EXECUTION

## 3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicate structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. 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.

## 3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches.
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
3. Trees: 10 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03300 "Cast-In-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

## 3.3 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 16130 "Raceways and Boxes." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

## 3.4 GROUNDING

A. Ground metal poles and support structures according to Section 16060 "Grounding and Bonding."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 16060 "Grounding and Bonding."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

## 3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. 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 IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
d. IESNA LM-64, "Photometric Measurements of Parking Areas."
e. IESNA LM-72, "Directional Positioning of Photometric Data."
f. IESNA LM-79/80, “Measuring Lumen Maintenance of LED Light Sources”
g. IESNA TM21-11, “Projecting Long Term Lumen Maintenance of LED Light Sources”
h. IESNA LM-82-11, “Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature”

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.

## 3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 16521

# SECTION 16711 - PATHWAYS FOR COMMUNICATIONS 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 and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 02584 "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
2. Section 16130 "Raceways and Boxes" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
3. Section 16712 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

### 1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

### 1.4 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. O-Z/Gedney; a brand of EGS Electrical Group.
3. Republic Conduit.
4. Robroy Industries.
5. Thomas & Betts Corporation.
6. Wheatland Tube Company; a division of John Maneely Company.

B. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

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: Steel.
b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, 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 IMC, GRC, or ARC: 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 AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Lamson & Sessions; Carlon Electrical Products.
3. RACO; a Hubbell company.
4. Thomas & Betts Corporation.

B. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Rigid HDPE: Comply with UL 651A.

E. Continuous HDPE: Comply with UL 651B.

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Maxcell Innerduct per IT consultant.

B. Description: Comply with UL 2024; flexible-type pathway, approved for general-use installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. Erickson Electrical Equipment Company.
3. Hoffman; a Pentair company.
4. Hubbell Incorporated; Killark Division.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. RACO; a Hubbell company.
7. Spring City Electrical Manufacturing Company.
8. Thomas & Betts Corporation.
9. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.

2. 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, ferrous alloy, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

K. Gangable boxes are allowed.

L. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 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:

a. Material: Fiberglass.
b. Finished inside with radio-frequency-resistant paint.

3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, Type 1, galvanized-steel 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.

## 2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

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.
3. Comply with TIA-569-B.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation; Hubbell Power Systems.
    d. Oldcastle Precast, Inc.; Christy Concrete Products.
    e. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

3. Standard: Comply with SCTE 77.
4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, "COMMUNICATIONS.".
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of reinforced concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation; Hubbell Power Systems.
    d. Nordic Fiberglass, Inc.
    e. Oldcastle Precast, Inc.; Christy Concrete Products.
    f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

3. Standard: Comply with SCTE 77.
4. Color of Frame and Cover: Gray.
5. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
6. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
7. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
8. Cover Legend: Molded lettering, "COMMUNICATIONS.".
9. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
10. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

# PART 3 - EXECUTION

## 3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC concrete encased or Type EPC-80-PVC, direct buried.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: GRC.
6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.

7. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, optical-fiber-cable pathway.
8. 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 Pathway Size: 3/4-inch trade size. Minimum size for optical-fiber cables is 1 inch.

D. Pathway Fittings: Compatible with pathways 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 compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

## 3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Comply with requirements in Section 16073 "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 pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

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. Pathways are not permitted to be embedded in slabs.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for pathways.

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 pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. 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.

P. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

R. Plenum-type cable shall be supported by metal j-hooks. The Contractor must submit for the approval of all j-hooks. J-hooks shall be mounted within 18” each direction from where the cable enters or exits a conduit, within 12” each direction of all 90º inside and outside corners and each 4 linear feet along the run of the cable. All cables shall be secured to the two immediate j-hooks located at outside corners with a ¼” minimum size, plastic or nylon cable-tie, leaving adequate slack in the cables to prevent the abrasion of the cables’’ jacket. The cables shall be pulled tight and secured to a h-hook each 20 linear feet to prevent excessive sagging of the cables.

S. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

U. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, 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 pathway sealing fittings according to NFPA 70.

V. Install devices to seal pathway 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 pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

W. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

X. 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 and EMT 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 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.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. 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.

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 surface 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. 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.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

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 Section 02300 "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 02300 "Earthwork."
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 Section 02300 "Earthwork."
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 or PVC-coated rigid steel conduit elbows.

    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.

5. 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.
6. Underground Warning Tape: Comply with requirements in Section 16075 "Electrical Identification."

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 COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16092 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07841 "Through-Penetration Firestop Systems."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or 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 16711

# SECTION 16720 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

## 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. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Air-sampling smoke detectors.
5. Nonsystem smoke detectors.
6. Heat detectors.
7. Notification appliances.
8. Magnetic door holders.
9. Remote annunciator.
10. Addressable interface device.
11. Digital alarm communicator transmitter.

B. Related Requirements:

1. Section 16718 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

### 1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
    d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    e. Locate detectors according to manufacturer's written recommendations.
    f. Show air-sampling detector pipe routing.

13. Include speaker/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, 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.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01782 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Device address list.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

## 1.8 PROJECT CONDITIONS

A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as a complete system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe or speaker/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. 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.

F. Space provisions for future connection to existing buildings via fiber optic interface card.

## 2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.

2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Activate alarm communication system.
4. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
5. Record events in the system memory.
6. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Alert and Action signals of air-sampling detector system.
2. User disabling of zones or individual devices.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
2. Record the event on system printer.
3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
4. Display system status on graphic annunciator.

## 2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

## 2.4 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Notifier.
2. SimplexGrinnell LP.
3. EST- Edwards Systems.

C. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

    a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer.
    c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    d. The FACP shall be listed for connection to a central-station signaling system service.
    e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit 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, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

E. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit 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, two line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

F. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 0.
3. Install no more than 75% capacity of addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for central-station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB or RS 232 port for PC configuration.
    d. One RS 232 port for VESDA HLI connection.
    e. One RS 232 port for voice evacuation interface.

G. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

H. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

J. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium.

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.

## 2.5 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Notifier.
2. SimplexGrinnell LP.
3. EST - Edwards Systems.

C. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.

2. Station Reset: Key- or wrench-operated switch.
3. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

## 2.6 SYSTEM SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Notifier.
2. SimplexGrinnell LP.
3. EST – Edwards Systems.

C. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to 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.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

D. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).
    f.

E. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.7 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

## 2.8 MULTICRITERIA DETECTORS

A. Mounting: Twist-lock base interchangeable with smoke-detector bases.

B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.

D. Test button tests all sensors in the detector.

E. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.
3. Present sensitivity selected.
4. Sensor range (normal, dirty, etc.).

F. Sensors: The detector shall be comprised of four sensing elements including a smoke sensor, a carbon monoxide sensor, an infrared sensor, and a heat sensor.

1. Smoke sensor shall be photoelectric type as described in "System Smoke Detectors" Article.

2. Carbon monoxide sensor shall be as described in "Carbon Monoxide Detectors" Article.
3. Heat sensor shall be as described in "Heat Detectors" Article.
4. Each sensor shall be separately listed according to requirements for its detector type.

## 2.9 HEAT DETECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. Notifier.
2. SimplexGrinnell LP.
3. EST – Edwards Systems.

C. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

D. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

E. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.10 AIR-SAMPLING SMOKE DETECTOR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ansul Incorporated; Tyco International Ltd.
2. Fenwal Protection Systems; A UTC Fire & Security Company.
3. Fike Corporation.
4. Notifier.
5. Xtralis Pty Ltd.

C. General Description:

1. Air-sampling smoke detector shall be laser based using a piping system and a fan to transport the particles of combustion to the detector.
2. Provide two levels of alarm from each zone covered by the detector and two supervisory levels of alarm from each detector.
3. The air being sampled shall pass through filters to remove dust particulates greater than 20 microns before entering the detection chamber.

4. Detectors shall have the capability via RS 485 to connect up to 100 detectors in a network.
5. Detectors shall communicate with the fire-alarm control unit via addressable, monitored dry contact closures, RS 485, and interface modules. Provide a minimum of six relays, individually programmable remotely for any function.
6. Pipe airflow balancing calculations shall be performed using approved calculation software.

D. Detector:

1. Detector, Filter, Aspirator, and Relays: Housed in a mounting box and arranged in such a way that air is drawn from the detection area and a sample passed through the dual-stage filter and detector by the aspirator.
2. Obscuration Sensitivity Range: 0.005 - 6 percent obs/ft..
3. Four independent, field-programmable, smoke-alarm thresholds per sensor pipe and a programmable scan time delay. The threshold set points shall be programmable.

    a. The four alarm thresholds may be used as follows:

        1) Alarm Level 1 (Alert): Activate a visual and an audible supervisory alarm.
        2) Alarm Level 2 (Action): Activate shutdown of electrical/HVAC equipment and activate a visual and an audible supervisory alarm.
        3) Alarm Level 3 (Fire 1): Activate building alarm systems and initiate call to fire response unit.
        4) Alarm Level 4 (Fire 2): Activate suppression system or other countermeasures.

    b. Final Detection System Settings: Approved by Architect.
    c. Initial Detection Alarm Settings:

        1) Alarm Level 1 (Alert): 0.08 percent obs/ft..
        2) Alarm Level 2 (Action): 1.0 percent obs/ft..
        3) Alarm Level 3 (Fire 1): 2.0 percent obs/ft..
        4) Alarm Level 4 (Fire 2): 4.0 percent obs/ft..

4. Power Supply:

    a. Regulated 24-V dc, monitored by the fire-alarm control unit, with battery backup.
    b. Battery backup shall provide 24 hours' standby, followed by 30 minutes at maximum connected load.

5. Detector shall also transmit the following faults:

    a. Detector.
    b. Airflow.
    c. Filter.
    d. System.
    e. Zone.
    f. Network.
    g. Power.

6. Provide four in-line sample pipe inlets that shall contain a flow sensor for each pipe inlet. The detector shall be capable of identifying the pipe from which smoke was detected.
7. Aspirator: Air pump capable of allowing for multiple sampling pipe runs up to 650 feet (200 m) in total, (four pipe runs per detector) with a transport time of less than 120 seconds from the farthest sample port.
8. Air-Sampling Flow Rates Outside Manufacturer's Specified Range: Result in a trouble alarm.
9. Provide software-programmable relays rated at 2 A at 30-V dc for alarm and fault conditions.
10. Provide built-in event and smoke logging; store smoke levels, alarm conditions, operator actions, and faults with date and time of each event. Each detector (zone) shall be capable of storing up to 18,000 events.

11. Urgent and Minor Faults. Minor faults shall be designated as trouble alarms. Urgent faults, which indicate the unit may not be able to detect smoke, shall be designated as supervisory alarms.

E. Sampling Tubes:

1. Smooth bore with a nominal 1-inch (25-mm) OD and a 7/8-inch (21-mm) ID. Sampling pipe with between 5/8- and 1-inch (15- and 25-mm) ID can be used in specifically approved locations when recommended by manufacturer.
2. Pipe Material: CPVC and complying with UL 1887, "Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics."
3. Joints in the sampling pipe shall be airtight. Use solvent cement approved by the pipe manufacturer on all joints except at entry to the detector.
4. Identify piping with labels reading: "Aspirating Smoke Detector Pipe - Do Not Paint or Disturb" along its entire length at regular intervals according to NFPA 72.
5. Support pipes at not more than 60-inch (1520-mm) centers.
6. Fit end of each trunk or branch pipe with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

F. Sampling Holes:

1. Sampling holes of 5/64 inch (2 mm), or other sized holes per manufacturer's written instructions, shall be separated by not more than the maximum distance allowable for conventional smoke detectors. Intervals may vary according to calculations.
2. Follow manufacturer's written recommendations to determine the number and spacing of sampling points and the distance from sampling points to ceiling or roof structure and to forced ventilation systems.
3. Each sampling point shall be identified by an applied decal.

## 2.11 NOTIFICATION APPLIANCES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cooper Wheelock.
2. Federal Signal Corporation.
3. GE UTC Fire & Security; A United Technologies Company.
4. Gentex Corporation.
5. Harrington Signal, Inc.
6. Keltron Corporation.
7. Mircom Technologies, Ltd.
8. Siemens Industry, Inc.; Fire Safety Division.
9. SimplexGrinnell LP.
10. System Sensor.

C. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

D. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, 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, equipped for mounting as indicated, and with screw terminals for system connections.

E. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

F. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

G. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

H. Speakers: High quality voice and tone reproduction with taps for ¼, ½, 1 or 2 watt at 25 or 70.7 VRMS. Capacitor input for connection to supervised notification appliance circuits. Speakers are wired separately from strobe wiring. Listed to UL 1480 and to ULC S541 with 2W tap.

I. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished red.

J. Exit Marking Audible Notification Appliance:

1. Exit marking audible notification appliances shall meet the audibility requirements in NFPA 72.
2. Provide exit marking audible notification appliances at the entrance to all building exits.
3. Provide exit marking audible notification appliances at the entrance to areas of refuge with audible signals distinct from those used for building exit marking.

## 2.12 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.13 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

## 2.14 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 16074 "Vibration and Seismic Controls for Electrical Systems."

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

H. 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.

I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

## 3.3 PATHWAYS

A. Pathways above accessible ceiling locations may be routed exposed via UL listed cable supports. All other cable shall be in conduit.

1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

## 3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 08710 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Smoke dampers in air ducts of designated HVAC duct system. Coordinate exact locations with Division 15.
2. Magnetically held-open doors.
3. Supervisory connections at valve supervisory switches.

## 3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16075 "Electrical Identification."

B. Install framed instructions in a location visible from fire-alarm control unit.

## 3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

## 3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

F. Fire-alarm system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

## 3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

## 3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

## 3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

**END OF SECTION**