

# Issued for Construction Specifications Manual

## **Cumberland County Court House**

AC-1 Replacement & Controls Upgrade

142 Federal St. Portland, Maine



Submitted by:

SMRT Architects and Engineers June 21, 2024 Project # 21254-02 smrtinc.com

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### 1.1 PROJECT MANUAL – ISSUED FOR CONSTRUCTION

- A. Cumberland County Courthouse- AC-1 Replacement and Controls Upgrades
- B. Cumberland County Courthouse.
- C. Portland, Maine.
- D. Architect Project No. 21254-02.
- E. SMRT Architects and Engineers.
- F. 75 Washington Avenue, Suite 3A.
- G. Portland, Maine.
- H. Phone: 1-877-700-7678.
- I. Issued: June 21, 2024.

END OF DOCUMENT 000101

### DOCUMENT 001116 - INVITATION TO BID

### 1.1 PROJECT INFORMATION

- A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification. AC-1 Replacement and Controls Upgrades
  - 1. Project Location: 142 Federal Street, Portland, Maine.
- C. Owner: Cumberland County Maine .
  - 1. Owner's Representative: William Trufant
- D. Architect: SMRT Architects and Engineers, 75 Washington Ave. Suite 3 Portland, ME 04101.
- E. Project Description: Project consists of removing and replacing the existing air handling unit located in the ground floor with a new roof top unit, the erection of a new duct enclosure tower and replacement of VAV boxes and controls as well as other Work indicated in the Contract Documents.
- F. Construction Contract: Bids will be received for the following Work:
  - 1. General Contract (all trades).

### 1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
  - 1. Bid Date: August 1, 2024.
  - 2. Bid Time: 2:00 p.m., local time.
  - 3. Location: Cumberland County Maine, 142 Federal Street, Portland, Maine 04101.
- B. Bids will be thereafter publicly opened and read aloud.
  - 1. Bid opening will be held in Feeney Room at 142 Federal Street, Portland Maine.

### 1.3 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

### 1.4 PREBID CONFERENCE

A. A mandatory prebid conference and walkthrough for all bidders will be held at the project location on July 10, 2024 10:00 a.m., local time. Prospective bidders are required to attend.

### 1.5 DOCUMENTS

A. Online Procurement and Contracting Documents: Obtain access after June 27, 2024 by contacting XPress Copy, 17 Westfield St, Portland, ME 04102, (207) 775-2444 for printed copies or by contacting the Architect for electronic copies. Online access will be provided to all registered bidders and suppliers.

### 1.6 TIME OF COMPLETION

- A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.
  - 1. Anticipated Construction Schedule:
    - a. Contract Award: August 22, 2024.
    - b. Substantial Completion: August 15, 2025.
    - c. Final Contractor Closeout: August 29, 2025.

### 1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

END OF DOCUMENT 001116

### DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

### 1.1 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
  - 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113



### Instructions to Bidders

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

Cumberland County Courthouse AC-1 Replacement and Controls Upgrades 142 Federal Street Portland, ME 04101

**THE OWNER:** *(Name, legal status, address, and other information)* 

Cumberland County Maine 142 Federal Street Portland, ME 04101

**THE ARCHITECT:** *(Name, legal status, address, and other information)* 

SMRT, Inc. 75 Washington Ave Suite 3-A Portland, ME 04101

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#### ADDITIONS AND DELETIONS:

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

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612<sup>™</sup>–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

#### ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

#### ARTICLE 2 **BIDDER'S REPRESENTATIONS**

§ 2.1 By submitting a Bid, the Bidder represents that:

- the Bidder has read and understands the Bidding Documents; .1
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

#### **ARTICLE 3 BIDDING DOCUMENTS**

### § 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

By email to SMRT: Emily Cooper - ecooper@smrtinc.com or paper copy from Xpress Copy Services, 17 Westfield Street, Portland, ME 04102 (207) 775-2444

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§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

### § 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids. (Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

By email to: Emily Cooper - ecooper@smrtinc.com

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

#### § 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

#### § 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

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§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

### § 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

By email from: Emily Cooper- ecooper@smrtinc.com

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

### ARTICLE 4 BIDDING PROCEDURES

#### § 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

### § 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security: (Insert the form and amount of bid security.)

Bid Bond or certified check in the amount of 5% of the bid amount.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

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§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310<sup>TM</sup>, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning60 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

### § 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below: (Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Paper copy by certified mail or in person to: **Cumberland County** 142 Federal Street **Facilities Department** Portland, ME 04101 Attention: Bill Trufant

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

### § 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

If Bid is determined to be the low acceptable bid, the Owner may elect to retain the bid security, in an amount not to exceed the difference between the next acceptable low Bid.

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### ARTICLE 5 CONSIDERATION OF BIDS

### § 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

### § 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

### § 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

#### ARTICLE 6 POST-BID INFORMATION

### § 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305<sup>™</sup>, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

### § 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

### § 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- a designation of the Work to be performed with the Bidder's own forces; .1
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each: and
- names of persons or entities (including those who are to furnish materials or equipment fabricated to a .3 special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

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#### PERFORMANCE BOND AND PAYMENT BOND ARTICLE 7

### § 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

### § 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

#### ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS **ARTICLE 8**

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

AIA Document A101<sup>TM</sup>–2017, Standard Form of Agreement Between Owner and Contractor, unless .1 otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

Included by reference.

.2 AIA Document A101<sup>TM</sup>–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below. (Insert the complete AIA Document number, including year, and Document title.)

Included by reference.

.3 AIA Document A201<sup>TM</sup>–2017, General Conditions of the Contract for Construction, unless otherwise stated below.

(Insert the complete AIA Document number, including year, and Document title.)

Included by reference.

.4 AIA Document E203<sup>TM</sup>–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below: (Insert the date of the E203-2013.)

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n/a

.5 Drawings

	Number As indicated on Drawing -G001	Title	Date	
6	Specifications			
	<b>Section</b> As listed in Project Manual Section 000110 – Table of Contents	Title	Date	Pages
7	Addenda:			
	Number	Date	Pages	

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ n/a ] AIA Document E204<sup>™</sup>–2017, Sustainable Projects Exhibit, dated as indicated below: (Insert the date of the E204-2017.)

[ **n/a** ] The Sustainability Plan:

Title	Date	Pages	
[ <b>n/a</b> ] Supplementary and other Co	onditions of the Contract:		
Document	Title	Date	Pages

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

Cumberland County Maine Federally Required Provisions Pursuant To The American Rescue Act.

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User Notes:
(1433745506)

## Additions and Deletions Report for

AIA<sup>®</sup> Document A701<sup>®</sup> – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 09:51:43 ET on 06/21/2024.

### PAGE 1

Cumberland County Courthouse AC-1 Replacement and Controls Upgrades <u>142 Federal Street</u> <u>Portland, ME 04101</u>

•••

Cumberland County Maine 142 Federal Street Portland, ME 04101

•••

<u>SMRT, Inc.</u> <u>75 Washington Ave</u> <u>Suite 3-A</u> <u>Portland, ME 04101</u> **PAGE 2** 

By email to SMRT: Emily Cooper - ecooper@smrtinc.com or paper copy from Xpress Copy Services, 17 Westfield Street, Portland, ME 04102 (207) 775-2444 PAGE 3

By email to: Emily Cooper - ecooper@smrtinc.com PAGE 4

By email from: Emily Cooper- ecooper@smrtinc.com

Bid Bond or certified check in the amount of 5% of the bid amount. PAGE 5

**§ 4.2.4** The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, <u>beginning-beginning60</u> days after the opening of Bids, withdraw its Bid and request the return of its bid security.

•••

Paper copy by certified mail or in person to: Cumberland County

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142 Federal Street Facilities Department Portland, ME 04101 Attention: Bill Trufant

### If Bid is determined to be the low acceptable bid, the Owner may elect to retain the bid security, in an amount not to exceed the difference between the next acceptable low Bid. **PAGE 7**

Included by reference.

...

Included by reference.

...

• • •

...

Included by reference.

PAGE 8

<u>n/a</u>

As indicated on Drawing -G001

As listed in Project Manual Section 000110 – Table of Contents

[<u>n/a</u>] AIA Document E204<sup>TM</sup>–2017, Sustainable Projects Exhibit, dated as indicated below:

[ <u>n/a</u>] The Sustainability Plan:

[<u>n/a</u>] Supplementary and other Conditions of the Contract:

Cumberland County Maine Federally Required Provisions Pursuant To The American Rescue Act.

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## **Certification of Document's Authenticity**

AIA<sup>®</sup> Document D401<sup>™</sup> – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 09:51:43 ET on 06/21/2024 under Order No. 4104242760 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701<sup>TM</sup> - 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

(Signed)			
(Title)			
(Dated)			

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### DOCUMENT 002213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

### 1.1 INSTRUCTIONS TO BIDDERS

- A. Instructions to Bidders for Project consist of the following:
  - 1. AIA Document A701, "Instructions to Bidders," a copy of which is bound in this Project Manual.
  - 2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

### 1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

### 1.3 ARTICLE 2 - BIDDER'S REPRESENTATIONS

- A. Add Section 2.1.3.1:
  - 1. 2.1.3.1 The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
- B. Add Section 2.1.5:
  - 1. 2.1.5 The Bidder is a properly licensed Contractor according to the laws and regulations of the State of Maine and meets qualifications indicated in the Procurement and Contracting Documents.
- C. Add Section 2.1.6:
  - 1. 2.1.6 The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

### 1.4 ARTICLE 3 - BIDDING DOCUMENTS

- A. 3.2 Interpretation or Correction of Procurement and Contracting Documents:
  - 1. Add Section 3.2.2.1:
    - a. 3.2.2.1 Submit Bidder's Requests for Interpretation using Architect's Newforma project information management program.

- 1) Requests to be submitted to Emily C. Cooper, AIA, LEED AP, ecooper@smrtinc.com and DocCtrl@smrtinc.com.
- B. 3.4 Addenda:
  - 1. Delete Section 3.4.3 and replace with the following:
    - a. 3.4.3 Addenda may be issued at any time prior to the receipt of bids.
  - 2. Add Section 3.4.4.1:
    - a. 3.4.4.1 Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
      - 1) 3.4.4.1.1 Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
      - 2) 3.4.4.1.2 Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

### 1.5 ARTICLE 4 - BIDDING PROCEDURES

- A. 4.1 Preparation of Bids:
  - 1. Add Section 4.1.7.1:
    - a. 4.1.7.1 Bid submission shall include a filled out copy of the document "Cumberland County Maine Federally Required Provisions Pursuant To The American Rescue Act" a copy of which is included in the Project Manual after Document 004113 "Bid Form - Stipulated Sum (Single-Prime Contract).
  - 2. Add Section 4.1.9:
    - a. 4.1.9 Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.
  - 3. Add Section 4.1.10:
    - a. 4.1.10 Bids shall include sales and use taxes. Contractors shall show separately with each monthly payment application the sales and use taxes paid by them and their subcontractors in the form indicated. Reimbursement of sales and use taxes, if any, shall be applied for by Owner for the sole benefit of Owner.
- B. 4.3 Submission of Bids:
  - 1. Add Section 4.3.1.2:
    - a. 4.3.1.2 Include Bidder's Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.
- C. 4.4 Modification or Withdrawal of Bids:
  - 1. Add the following sections to 4.4.2:
    - a. 4.4.2.1 Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of

attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.

- b. 4.4.2.2 Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.
- D. 4.6 Subcontractors, Suppliers, and Manufacturers List Bid Supplement:
  - 1. Add Section 4.6:
    - a. 4.6 Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than five business days following Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling ten percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

### 1.6 ARTICLE 5 - CONSIDERATION OF BIDS

- A. 5.2 Rejection of Bids:
  - 1. Add Section 5.2.1:
    - a. 5.2.1 Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

### 1.7 ARTICLE 6 - POSTBID INFORMATION

- A. 6.1 Contractor's Qualification Statement:
  - 1. Add Section 6.1.1:
    - a. 6.1.1 Submit Contractor's Qualification Statement no later than five business days following Architect's request.
- B. 6.3 Submittals:
  - 1. Add Section 6.3.1.4:

### 21254-02 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS 002213 - 3

a. 6.3.1.4 - Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than five business days following Architect's request.

### 1.8 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

- A. 7.1 Bond Requirements:
  - 1. Add Section 7.1.1.1:
    - a. 7.1.1.1 Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.
- B. 7.2 Time of Delivery and Form of Bonds:
  - 1. Delete the first sentence of Section 7.2.1 and insert the following:
    - a. The Bidder shall deliver the required bonds to Owner no later than 10 days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.
  - 2. Delete Section 7.2.3 and insert the following:
    - a. 7.2.3 Bonds shall be executed and be in force on the date of the execution of the Contract.

### 1.9 ARTICLE 9 - EXECUTION OF THE CONTRACT

- A. Add Article 9:
  - 1. 9.1.1 Subsequent to the Notice of Intent to Award, and within five days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.
  - 2. 9.1.2 Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
  - 3. 9.1.3 Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.
  - 4. 9.1.4 In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or readvertise for bids.

END OF DOCUMENT 002213

### DOCUMENT 002513 - PREBID MEETINGS

### 1.1 PREBID MEETING

- A. Architect will conduct a Prebid meeting as indicated below:
  - 1. Meeting Date: July 10, 2024.
  - 2. Meeting Time: 10:00 a.m., local time.
  - 3. Location: At project site .

### B. Attendance:

- 1. Prime Bidders: Attendance at Prebid meeting is mandatory.
- 2. Subcontractors: Attendance at Prebid meeting is recommended.
- 3. Notice: Bids will only be accepted from prime bidders represented on Prebid Meeting signin sheet.
- C. Bidder Questions: Submit written questions to be addressed at Prebid meeting minimum of two business days prior to meeting.
- D. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
  - 1. Procurement and Contracting Requirements:
    - a. Advertisement for Bids.
    - b. Instructions to Bidders.
    - c. Bidder Qualifications.
    - d. Bonding.
    - e. Insurance.
    - f. Bid Security.
    - g. Bid Form and Attachments.
    - h. Bid Submittal Requirements.
    - i. Bid Submittal Checklist.
    - j. Notice of Award.
  - 2. Communication during Bidding Period:
    - a. Obtaining documents.
    - b. Access to Project Web site.
    - c. Bidder's Requests for Information.
    - d. Bidder's Substitution Request/Prior Approval Request.
    - e. Addenda.
  - 3. Contracting Requirements:
    - a. Agreement.
    - b. The General Conditions.
    - c. The Supplementary Conditions.
    - d. Other Owner requirements.
  - 4. Construction Documents:
    - a. Scopes of Work.
    - b. Temporary Facilities.
- 21254-02

### PREBID MEETINGS

- c. Use of Site.
- d. Work Restrictions.
- e. Alternates, Allowances, and Unit Prices.
- f. Substitutions following award.
- 5. Schedule:
  - a. Project Schedule.
  - b. Contract Time.
  - c. Liquidated Damages.
  - d. Other Bidder Questions.
- 6. Site/facility visit or walkthrough.
- 7. Post-Meeting Addendum.
- E. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees and others known by the issuing office to have received a complete set of Procurement and Contracting Documents. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
  - 1. Sign-in Sheet: Minutes will include list of meeting attendees.
  - 2. List of Planholders: Minutes will include list of planholders.

END OF DOCUMENT 002513

### DOCUMENT 004113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

### 1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_
- B. Project Name: Cumberland County Courthouse AC-1 Replacement and Controls Upgrades
- C. Project Location: 142 Federal Street, Portland, Maine.
- D. Owner: Cumberland County Maine .
- E. Architect: SMRT Architects and Engineers, 75 Washington Ave. Suite 3 Portland, ME 04101 .
- F. Architect Project Number: 21254-02.

### 1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by SMRT Architects and Engineers and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

### 1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).
- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

### 1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within the time frame listed in the Invitation to Bid.

### 1.5 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
  - 1. Addendum No. 1, dated \_\_\_\_\_\_.
  - 2. Addendum No. 2, dated \_\_\_\_\_\_.
  - 3. Addendum No. 3, dated \_\_\_\_\_\_.
  - 4. Addendum No. 4, dated \_\_\_\_\_\_.

### 1.6 BID SUPPLEMENTS

- A. The following supplements are a part of this Bid Form and are attached hereto.
  - 1. Cumberland County Maine Federally Required Provisions Pursuant To The American Rescue Act.
  - 2. Bid Form Supplement Bid Bond Form (AIA Document A310-2010) or certified check.

### 1.7 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of Maine, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

### 1.8 SUBMISSION OF BID

A.	Respectfully submitted this day of	, 2023 .	
В.	Submitted By: corporation).	(Name of	bidding firm or
C.	Authorized Signature:	(Handwrit	tten signature).
D.	Signed By:(Type or print name).		or print name).
E.	Title:	_(Owner/Partner/President/V	ice President).
F.	Witnessed By:	(Handw	vritten signature).
G.	Attest:	(Handwrit	ten signature).
Н. 21254-02	By: 2 BID FORM - STIPULATED SUM (S	(Type or MINGLE-PRIME CONTRAC	r print name). T)

Cumber AC-1 Ro Portland	land County Courthouse eplacement and Controls Upgrades I, ME	Issued for Constructi June 21, 20	
I.	Title:	(Corporate Secretary or Assistant Secretary).	
J.	Street Address:		
K.	City, State, Zip:		
L.	Phone:		
M.	License No.:		
N.	Federal ID No.:	(Affix Corporate Seal Here).	

END OF DOCUMENT 004113



## FEDERALLY REQUIRED PROVISIONS PURSUANT TO THE AMERICAN RESCUE PLAN ACT

If you have any questions while completing this paperwork

### **Please contact:**

Cumberland County Compliance and Audit Manager 142 Federal Street Room 100 Portland ME, 04101 207-209-4940

warren@cumberlandcounty.org

### The American Rescue Plan Act

Each Prime contractor or subcontractor shall state as an initial part of contract, compliance with PART 200 - Uniform Administrative Requirements, Cost Principles, & Audit Requirements for Federal Awards. <u>All contracts</u> must contain all of the following documents, signed and completed.

## **Required Document Checklist**

## **Prime Contractor**

- 1. □ Certification of the Prime Contractor regarding Disbarment (Please include a print out from SAMs, showing standings)
- 3. 
  □ Certification of the Prime Contractor regarding EEO and signed EEO Statement

## **Subcontractor**

- **1.**  $\Box$  Certification of the Subcontractor regarding Disbarment
- 3. 
  □ Certification of the Subcontractor regarding EEO and signed EEO Statement

\*NOTE: Prime Contractors & Subcontractor MUST READ THE FEDERAL PROVISIONS REQUIREMENTS OF THIS PACKET PRIOR TO WORKING ON THIS PROJECT\*

### **CONTRACTOR DISBARRED OR SUSPENSION**

**Prime Contractor** 

Contractor:	Telephone: Ext
Contact Person:	Fax:
E-mail:	Tax ID:
BID PRICE: \$	<b>BID DATE:</b> //
PROJECT LOCATION:	_ PROJECT #

THIS CERTIFICATION IS REQUIRED BY THE REGULATIONS IMPLEMENTING EXECUTIVE ORDER 12549, DEBARMENT AND SUSPENSION, 29 CFR PART 98, SECTION 98.510, PARTICIPANTS' RESPONSIBILITIES. THE REGULATIONS WERE PUBLISHED AS PART VII OF THE MAY 26, 1988 FEDERAL REGISTER (PAGES 19160-19211).

- 1. THE PROSPECTIVE PRIMARY PARTICIPANT CERTIFIES TO THE BEST OF ITS KNOWLEDGE AND BELIEF THAT IT AND ITS PRINCIPALS:
  - a) ARE NOT PRESENTLY DEBARRED, SUSPENDED, PROPOSED FOR DEBARMENT, DECLARED INELIGIBLE, OR VOLUNTARILY EXCLUDED FROM COVERED TRANSACTIONS BY ANY FEDERAL DEPARTMENT OR AGENCY;
  - b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - c) ARE NOT PRESENTLY INDICTED FOR OR OTHERWISE CRIMINALLY OR CIVILLY CHARGED BY A GOVERNMENT ENTITY (FEDERAL, STATE OR LOCAL) WITH COMMISSION OF ANY OF THE OFFENSES ENUMERATED IN PARAGRAPH 1.B OF THIS CERTIFICATION; AND
  - d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- 2. WHERE THE PROSPECTIVE PRIMARY PARTICIPANT IS UNABLE TO CERTIFY TO ANY OF THE STATEMENTS IN THIS CERTIFICATION, SUCH PROSPECTIVE PARTICIPANT SHALL ATTACH AN EXPLANATION TO THIS PROPOSAL.

NAME AND TITLE, AUTHORIZED REPRESENTATIVE

SIGNATURE & DATE

**\*\*\*Please attach a print out of good standing from SAM.Gov\*\*\*** 

### **CONFLICT OF INTEREST**

### 2 CFR 200.112 and 2 CFR 200.318

Conflicts of interest arise when officials or staff stand to benefit either directly themselves or indirectly through business partners or relatives from the awarding or contracting of grant funds. When conflicts of interest arise, ARPA Staff will identify, disclose, and manage them in compliance with Super Circular (2 CFR Part 200.112 Conflict of Interest) and 24 CFR Part 570.611 Conflict of Interest for ARPA.

In the procurement of supplies, equipment, construction, and services by the subrecipients, the conflict of interest provisions in 2 CFR 200.318 shall apply. In all cases not governed by 2 CFR 200.318, this policy will be followed. Such cases include the acquisition and disposition of real property and the provision of assistance by its subrecipients/entities to individuals, businesses, and other private entities under eligible activities that authorize such assistance (e.g., rehabilitation, preservation, and other improvements of private properties or facilities pursuant to §570.202; or grants, loans, and other assistance to businesses, individuals, and other private entities pursuant to §570.203, 570.204, 570.455, or 570.703(i)).

A Conflict of Interest is a real or apparent incompatibility between a person's private interests and his/her public or fiduciary duties. For the purposes of ARPA, the rule is that no persons who are a (n):

- Employee,
- Agent,
- Consultant,
- Officer,
- Elected Official, and/or
- Appointed official

### **OF THE:**

- Town, City or County under the Cumberland County jurisdiction.
- Recipient of ARPA funds (applies to all non-profit agencies)
- Federal Government

# CUMBERLAND COUNTY

### **WHO**:

- Exercise or have exercised any functions or responsibilities with respect to ARPA activities, and/or
- Are in a position to participate in decision making process or gain inside information with regard to such activities,

### SHALL NOT:

- Obtain a financial interest or benefit from a ARPA -assisted activity,
- Have a financial interest in any contract, subcontract, or agreement with respect to a ARPA -assisted activity, or with respect to the proceeds of the ARPA -assisted activity.

Either for themselves or those with *whom they have business or immediate family ties*, during their tenure or for one year thereafter.

### **EXCEPTIONS**

Upon the written request of the recipient, Treasury may grant an exception to the provisions of this section on a case-by-case basis when it has satisfactorily met the threshold requirements below:

Treasury will consider an exception only after the recipient has provided the following documentation:

- 1. A disclosure of the nature of the conflict, accompanied by an assurance that there has been public disclosure of the conflict and description of how the public disclosure was made. AND
- 2. An opinion from the Cumberland County-Legal Department must be obtained indicating the interest for which the exception is sought would not violate State or local law.

**IMPORTANT:** Mere submission of a request for an exception does not authorize a recipient to engage in any activity or enter into any contract that constitute a conflict. An exception is not granted until the subrecipient receives such determination in writing from the County as instructed by Treasury.

In order to successfully obtain an exception from Treasury, the following points must be addressed:

• Significant cost benefit or essential expertise to the project.

- Opportunity for open competitive bidding or negotiation
- Person affected:
  - Member of low or moderate income class of persons intended to be beneficiaries of the assisted activity.
  - Exception will permit such person to receive same benefits as the class.
- Person affected has withdrawn from his or her functions or responsibilities, or the decision making process with respect to the assisted activity.
- Interest or benefit was present *before* affected person was in the conflicting position.
- Undue hardship to subrecipient or person affected which weighed against public interest served by avoiding the prohibited conflict.
- Any other relevant considerations.

### \*\* CONFLICT OF INTEREST FORMS MUST BE SIGNED BY ADMINISTRATION, STAFF AND BOARD OF DIRECTORS.

# CONFLICT OF INTEREST 2 CFR 200.112 and 2 CFR 200.318

No employee, officer or agent of Cumberland County, or its set a sides communities, subgrantee or subrecipient shall participate in selection, award or administration of contract or conduct business with a vendor if a conflict of interest, real or apparent would be involved.

- A. the employee, officer or any agent
- B. a member of his/her immediate family
- C. his or her partner
- D. an organization, which employs or is about to employ, any of the above, has financial or other interest in the firm selected for award.

Cumberland County's, sub-grantee or subrecipient, officers, employees or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential

### CUMBERLAND COUNTY Maine

contractors, or parties to sub-agreements, vendors or potential vendors. Depending on gravity, violation of this Conflict of Interest could result in dismissal, probation or suspension of officers, employees or agents involved or termination of contractual agreements with subrecipients.

<u>Non-disclosure Policy</u> any Cumberland County employee, sub-grantee or subrecipient shall make no disclosure of verbal or written price quotations. Violation of the nondisclosure policy shall be subject to disciplinary action as provided by the County or termination of contractual agreements when a subrecipient/sub-grantee employee is involved.

**<u>Personal Interest</u>** No member of the County Commissioners or any officer or employee of the County, sub-grantee or subrecipient shall have a financial interest, direct or indirect or by reason of ownership of stock in any corporation, in any contract or in the sale to the County of Cumberland, sub-grantee or subrecipient or to a contractor supplying the County of Cumberland, sub-grantee or subrecipient of any land or rights or interest in any land, material, supplies, or services, or in any matter in which he acts for the County of Cumberland. Any willful violation of this section shall constitute malfeasance in office, and any officer or employee of the County of Cumberland, sub-grantee or subrecipient found guilty shall there by forfeit his or her office. Any violation of this section with the knowledge, express or implied, of the person or corporation contracting with the County of Cumberland, sub-grantee or subrecipient shall render the contract void by the Compliance and Audit Director or the County Commissioners.

Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when the transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Employee Print or type Name and Position/Title

Signature

Company Name

Date

**Federal Contract Provisions** 

### <u>CERTIFICATION OF PRIME CONTRACTOR REGARDING EQUAL</u> <u>EMPLOYMENT OPPORTUNITY</u>

**Certification by Prime** 

Name of prime contractor: \_\_\_\_\_

Address of prime contractor:

Tax ID # of prime contractor: \_\_\_\_\_

1. Contractor has participated in a previous contract or subcontract subject to the EEO Clause.

Yes No

2. Compliance reports were required to be filed in connection with such contract or subcontract.

Yes No

3. Contractor has filed all compliance reports due under applicable instructions, including SF-100.

\_\_\_\_Yes \_\_\_\_No

4. Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended? \_\_\_\_Yes \_\_\_\_No

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any contractor or prospective contractor, or any other of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause, and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the contractor has not filed a compliance report due under applicable instructions, such contractor shall be required to submit a compliance report within seven (7) calendar days after bid opening. No contract shall be awarded unless such report is submitted.

By signing below, you are certifying your answers to the four questions above were truthful:

Name and Title of Authorized Representative (print or type)

Signature of Authorized Representative

Date of Signature

**Federal Contract Provisions**
# CUMBERLAND COUNTY Maine

# EQUAL EMPLOYMENT OPPORTUNITY STATEMENT

E.O. 11246 requires covered contractors and subcontractors to refrain from discrimination and to engage in affirmative steps to ensure that applicants and employees receive equal employment opportunity regardless of race, color, religion, sex, sexual orientation, gender identity, and national origin. Additionally, E.O. 11246 prohibits contractors and subcontractors from taking adverse action against employees or applicants for asking about, discussing or disclosing their pay or the pay of their co-workers.

# During the performance of this contract, the contractor agrees as follows:

- The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.
- 2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- 3. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.
- 4. The contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

- 5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 6. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 7. In the event of the contractor's non-compliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 8. The contractor will include the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: *Provided*, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

General Contractor Signature

Date

General Contractor Printed Name

#### FEDERAL REQUIREMENTS FOR SLFRF

#### 1. TITLE VI OF THE CIVIL RIGHTS ACT OF 1964

(P.L. 88-352), as amended, (42 USC 2000d) and the requirements imposed by the Regulations of the Department of Commerce (15 CFR Part 8) issued pursuant to that Title. In accordance therewith no person in the United States shall, on the grounds of race, handicap, color, sex, national origin or familial status be excluded from participation in, be denied the benefits or be otherwise subjected to discrimination under any program or activity which is paid for with federal funds. The Owner further adds that there shall not be any form of discrimination by any party in any ARPA contract on the basis of familial status, sexual orientation or sex.

#### 2. REHABILATATION ACT OF 1973

29 USC 794, Executive Order 11914, Section 504. No otherwise qualified handicapped individual shall, solely by reason of his/her handicap, be denied the benefits of, be excluded from participation in, or be subjected to discrimination under any program or activity receiving federal financial assistance.

- 3. **SECTION 202 OF EXECUTIVE ORDER 11246** Applicable to Federally assisted construction contracts and related subcontracts. During the performance of this contract, the contractor agrees as follows:
  - A. The contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of Compensation; and selection for training, including apprenticeship.
  - B. The contractor shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this non-discrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
  - C. Contractors shall incorporate foregoing requirements in all subcontracts.
  - D. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration without regard to race, color, religion, sex, or national origin.
  - E. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Contract Compliance Officer advising the said labor union or workers' representative of the contractor's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
  - F. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
  - G. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Department and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
  - H. In the event of the contractor's noncompliance with the non-discrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
  - I. The contractor will include the provisions of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provision, including sanctions for non-compliance. Provided, however, that in the event a

contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Department the contractor may request the United States to enter into such litigation to protect the interest of the United States.

J. Except as otherwise provided under <u>41 CFR Part 60</u>, all contracts that meet the definition of "federally assisted construction contract" in <u>41 CFR Part 60-1.3</u> must include the equal opportunity clause provided under <u>41 CFR 60-1.4(b)</u>, in accordance with Executive Order 11246, "Equal Employment Opportunity" (<u>30 FR 12319, 12935, 3 CFR Part, 1964-1965</u> Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at <u>41 CFR part 60</u>, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor." The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on -the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, the following equal opportunity clause:

(b)The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor; state that all qualified applicants WM receive considerations for employment without regard to race, color, religion, sex, or national origin.

(c) The contractor will send to each labor union or representative of workers. With which he has a collective bargaining agreement or other contract.

- 4. Disbarment & Suspension. Debarment and Suspension (Executive Orders 12549 and 12689) A contract award (see <u>2 CFR</u> <u>180.220</u>) must not be made to parties listed on the government wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at <u>2 CFR 180</u> that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- 5. CERTIFICATION OF NONSEGREGATED FACILITIES AS REQUIRED BY THE MAY 19, 1967, ORDER (32 F.R. 74390 ON ELIMINATION OF SEGREGATED FACILITIES, BY THE SECRETARY OF LABOR. Prior to the award of any construction contract or subcontract, the Contractor shall submit signed Certification of Non-segregated Facilities Forms for him/herself and all subcontractors.

### 6. THE AGE DISCRIMINATION ACT OF 1975

No person in the United States shall, on the basis of age, be excluded from participation or be denied the benefits of, or be subjected to discrimination under, any program or activity undertaken with federal funds.

# 7. LABOR STANDARDS

Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or report and such that the construction of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or report all suspected or reported violations to

- A. Specific to ARAP and when it is the sole source of federal funds, Davis Bacon is NOT applicable unless the total cost of the project will exceed10 Million dollars:
- B. recipient may provide a certification that, for the relevant project, all laborers and mechanics employed by contractors and subcontractors in the performance of such project are paid wages at rates not less than those prevailing, as determined by the U.S. Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code (commonly known as the "Davis-Bacon Act"), for the corresponding classes of

laborers and mechanics employed on projects of a character similar to the contract work in the civil subdivision of the State (or the District of Columbia) in which the work is to be performed, or by the appropriate State entity pursuant to a corollary State prevailing-wage-in-construction law (commonly known as "baby Davis-Bacon Acts"). If such certification is not provided, a recipient must provide a project employment and local impact report detailing:

- (a) The number of employees of contractors and sub-contractors working on the project;
- (b) The number of employees on the project hired directly and hired through a third party;
- (c) The wages and benefits of workers on the project by classification; and
- (d) Whether those wages are at rates less than those prevailing.
- (e) The County must maintain sufficient records to substantiate this information upon request.
- (f) A recipient may provide a certification that a project includes a project labor agreement, meaning a pre-hire collective bargaining agreement consistent with section 8(f) of the National Labor Relations Act (29 U.S.C. 158(f)).
- 8. Contract Work Hours and Safely Standards Act (40 U.S.C. 327-333). All laborers and mechanics employed by contractors or subcontractors shall receive overtime compensation in accordance with and subject to the provisions of the Contract Work Hours and Safety Standards Act, and the contractors and subcontractors shall comply with all regulations issued pursuant to these acts and with other applicable Federal laws and regulations pertaining to labor standards. Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of <u>40 U.S.C. 3704</u> are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
- 9. <u>Rights to Inventions Made Under a Contract or Agreement.</u> If the Federal award meets the definition of "funding agreement" under <u>37 CFR § 401.2 (a)</u> and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of <u>37 CFR Part 401</u>, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.
- 10. <u>Copeland Anti-Kickback Act</u> requires that workers be paid at least once a week, and without any deductions or rebates except permissible deductions. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (<u>40 U.S.C. 3145</u>), as supplemented by Department of Labor regulations (<u>29 CFR Part 3</u>, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency

# 11. SPECIAL CONDITIONS PERTAINING TO HAZARDS, SAFETY STANDARDS AND ACCIDENT PREVENTION TITLE IV OF THE LEAD BASED PAINT POISONING PREVENTION ACT

**A. Lead-Based Paint Hazards** (Applicable to contracts for construction or rehabilitation of residential structures) The construction or rehabilitation of residential structures is subject to the HUD Lead-Based Paint regulations, 24 CFR Part 35. The contractor and Subcontractors shall comply with the provisions for the elimination of lead-based paint hazards under sub-part B of said regulations. The Owner will be responsible for the inspections and certifications required under Section 35.14(f) thereof.

**B.** Use of Explosives When the use of explosives is necessary for the prosecution of the work, the Contractor shall observe all local, state and federal laws in purchasing and handling explosives. The Contractor shall take all necessary precautions to protect completed work, neighboring property, water lines, or other underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats. The Contractor shall notify all owners of public utility property of intention to use explosives at least eight hours before blasting is done, close to such property. Any supervision of direction of use of explosives by the Engineer does not in any way reduce the responsibility of the Contractor or his Surety for damages that may be caused by such use.



**C. Danger Signals and Safely Devices** The Contractor shall make all necessary precautions to guard against damages to property and injury to persons. They shall put up and maintain in good condition, sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the Contractor fails or neglects to take such precautions, the Owner may have such lights and barricades installed and charge the cost of this work to the Contractor. Such action by the Owner does not relieve the Contractor of any liability incurred under these specifications or contract.

- 12. THE UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT OF 1970. (P.L. 91-646 as amended), 15 CFR Part 916 including amendments thereto and regulations there under, as provided by 1. M.R.SA 901 et seq. The Contractor and Grantee will ensure that all work performed under this Agreement will be done in accordance with this act.
- 13. ARCHITECTURAL BARRIERS ACT (P.L 90-480), 42 USC 4151, AS AMENDED, and the regulations issued or to be issued there under, prescribing standards for the design and construction of any building or facility intended to be accessible to the public or which may result in the employment of handicapped persons therein.
- 14. THE CLEAN AIR ACT AS AMENDED, 42 USC 1857 ED SEQ.9 THE FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED, 33 USC 1251 et seq. and the regulations of the Environmental Protection Agency with respect thereto, at 40 CFR Part 15, as amended from time to time. Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA). In no event shall any amount of the assistance provided under this Agreement be utilized with respect to a facility, which has given rise to a conviction under section 113(c) (1) of the Clean Air Act or section 309(c) of the Federal Water Pollution Control Act.
- 15. **MINORITY BUSINESS ENTERPRISES** Referenced in Executive Order #11625, OMEB Circular A-102 Attachment 0 Procurement Standards. Grantees are to give priority to Minority Business Enterprises in purchase of supplies, equipment, construction, and services.
- 16. SECTION 319 OF PUBLIC LAW 101-121The grantee shall comply with the requirements of Section 319 of Public Law 101-121 regarding government wide restrictions on lobbying.
- 17. Byrd Anti-Lobbying Amendment (<u>31 U.S.C. 1352</u>) Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by <u>31 U.S.C. 1352</u>. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award. See: <u>§ 200.323</u>. See <u>§ 200.216</u>. See <u>§ 200.322</u>. [78 FR 78608, Dec. 26, 2013, as amended at <u>79 FR 75888</u>, Dec. 19, 2014; <u>85 FR 49577</u>, Aug. 13, 2020]
- 18. **Remedial Actions**. In the event of Recipient's noncompliance with section 603 of the Act, other applicable laws, Treasury's implementing regulations, guidance, or any reporting or other program requirements, Treasury may impose additional conditions on the receipt of a subsequent tranche of future award funds, if any, or take other available remedies as set forth in 2 C.F.R. § 200.339. In the case of a violation of section 603(c) of the Act regarding the use of funds, previous payments shall be subject to recoupment as provided in section 603(e) of the Act.
- 19. **Hatch Act.** Recipient agrees to comply, as applicable, with requirements of the Hatch Act (5 U.S.C. §§ 1501-1508 and 7324-7328), which limit certain political activities of State or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.
- 20. **False Statements**. Recipient understands that making false statements or claims in connection with this award is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.

21. **Publications.** Any publications produced with funds from this award must display the following language: "This project [is being] [was] supported, in whole or in part, by federal award number [enter project FAIN] awarded to [name of Recipient] by the U.S. Department of the Treasury."

# 22. Debts Owed the Federal Government. Any funds paid to Recipient

- 1. in excess of the amount to which Recipient is finally determined to be authorized to retain under the terms of this award;
- 2. that are determined by the Treasury Office of Inspector General to have been misused; or
- 3. that are determined by Treasury to be subject to a repayment obligation pursuant to section 603(e) of the Act and have not been repaid by Recipient shall constitute a debt to the federal government.

23. **Disclaimer.** The United States expressly disclaims any and all responsibility or liability to Recipient or third persons for the actions of Recipient or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any other losses resulting in any way from the performance of this award or any contract, or subcontract under this award. The acceptance of this award by Recipient does not in any way establish an agency relationship between the United States and Recipient.

# 24. Protections for Whistleblowers.

a. In accordance with 41 U.S.C. § 4712, Recipient may not discharge, demote, or otherwise discriminate against an employee in reprisal for disclosing to any of the list of persons or entities provided below, information that the employee reasonably believes is evidence of gross mismanagement of a federal contract or grant, a gross waste of federal funds, an abuse of authority relating to a federal contract or grant, a substantial and specific danger to public health or safety, or a violation of law, rule, or regulation related to a federal contract (including the competition for or negotiation of a contract) or grant.

b. The list of persons and entities referenced in the paragraph above includes the following:

- i. A member of Congress or a representative of a committee of Congress;
- ii. An Inspector General;
- iii. The Government Accountability Office;
- iv. A Treasury employee responsible for contract or grant oversight or management;
- v. An authorized official of the Department of Justice or other law enforcement agency;
- vi. A court or grand jury; or

vii. A management official or other employee of Recipient, contractor, or subcontractor who has the responsibility to investigate, discover, or address misconduct.

c. Recipient shall inform its employees in writing of the rights and remedies provided under this section, in the predominant native language of the workforce.

25. Increasing Seat Belt Use in the United States. Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), Recipient should encourage its contractors to adopt and enforce on-the-job seat belt policies and programs for their employees when operating company-owned, rented or personally owned vehicles.

26. Reducing Text Messaging While Driving. Pursuant to Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), Recipient should encourage its employees, subrecipients, and contractors to adopt and enforce policies that ban text messaging while driving, and Recipient should establish workplace safety policies to decrease accidents caused by distracted drivers.

The Prime Contractor hereby agrees, to and will comply with the terms and use of the federal program and its provisions hereto as a condition of the Bid and thereby award. The contractor acknowledges that they have read and understand said provisions hereto.

Insert Name Here:

Authorized Representative: Title: Date signed:

# **Subcontractor Packet**

# **Subcontractor Checklist**

- 4. Certification of the Subcontractor regarding Federal Provisions

# SUB CONTRACTOR DISBARRED OR SUSPENSION

Subcontractor:	Telephone: Ext	
Contact Person:	Fax:	
E-mail:	Tax ID:	
BID PRICE: \$	BID DATE: //	_
PROJECT LOCATION:	PROJECT #	_

THIS CERTIFICATION IS REQUIRED BY THE REGULATIONS IMPLEMENTING EXECUTIVE ORDER 12549, DEBARMENT AND SUSPENSION, 29 CFR PART 98, SECTION 98.510, PARTICIPANTS' RESPONSIBILITIES. THE REGULATIONS WERE PUBLISHED AS PART VII OF THE MAY 26, 1988 FEDERAL REGISTER (PAGES 19160-19211).

- 3. THE PROSPECTIVE PRIMARY PARTICIPANT CERTIFIES TO THE BEST OF ITS KNOWLEDGE AND BELIEF THAT IT AND ITS PRINCIPALS:
  - e) ARE NOT PRESENTLY DEBARRED, SUSPENDED, PROPOSED FOR DEBARMENT, DECLARED INELIGIBLE, OR VOLUNTARILY EXCLUDED FROM COVERED TRANSACTIONS BY ANY FEDERAL DEPARTMENT OR AGENCY;
  - f) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction, violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - g) ARE NOT PRESENTLY INDICTED FOR OR OTHERWISE CRIMINALLY OR CIVILLY CHARGED BY A GOVERNMENT ENTITY (FEDERAL, STATE OR LOCAL) WITH COMMISSION OF ANY OF THE OFFENSES ENUMERATED IN PARAGRAPH 1.B OF THIS CERTIFICATION; AND
  - h) HAVE NOT WITHIN A THREE-YEAR PERIOD PRECEDING THIS APPLICATION/PROPOSAL HAD ONE OR MORE PUBLIC TRANSACTIONS (FEDERAL, STATE OR LOCAL) TERMINATED FOR CAUSE OR DEFAULT.
- 4. WHERE THE PROSPECTIVE PRIMARY PARTICIPANT IS UNABLE TO CERTIFY TO ANY OF THE STATEMENTS IN THIS CERTIFICATION, SUCH PROSPECTIVE PARTICIPANT SHALL ATTACH AN EXPLANATION TO THIS PROPOSAL.

NAME AND TITLE, AUTHORIZED REPRESENTATIVE

SIGNATURE & DATE



**Federal Contract Provisions** 

# **CONFLICT OF INTEREST**

# 2 CFR 200.112 and 2 CFR 200.318

Conflicts of interest arise when officials or staff stand to benefit either directly themselves or indirectly through business partners or relatives from the awarding or contracting of grant funds. When conflicts of interest arise, ARPA Staff will identify, disclose, and manage them in compliance with Super Circular (2 CFR Part 200.112 Conflict of Interest) and 24 CFR Part 570.611 Conflict of Interest for ARPA.

In the procurement of supplies, equipment, construction, and services by the subrecipients, the conflict of interest provisions in 2 CFR 200.318 shall apply. In all cases not governed by 2 CFR 200.318, this policy will be followed. Such cases include the acquisition and disposition of real property and the provision of assistance by its subrecipients/entities to individuals, businesses, and other private entities under eligible activities that authorize such assistance (e.g., rehabilitation, preservation, and other improvements of private properties or facilities pursuant to §570.202; or grants, loans, and other assistance to businesses, individuals, and other private entities pursuant to §570.203, 570.204, 570.455, or 570.703(i)).

A Conflict of Interest is a real or apparent incompatibility between a person's private interests and his/her public or fiduciary duties. For the purposes of ARPA, the rule is that no persons who are a (n):

- Employee,
- Agent,
- Consultant,
- Officer,
- Elected Official, and/or
- Appointed official

# **OF THE:**

- Town, City or County under the Cumberland County jurisdiction.
- Recipient of ARPA funds (applies to all non-profit agencies)
- Federal Government

# CUMBERLAND COUNTY

# **WHO**:

- Exercise or have exercised any functions or responsibilities with respect to ARPA activities, and/or
- Are in a position to participate in decision making process or gain inside information with regard to such activities,

# SHALL NOT:

- Obtain a financial interest or benefit from a ARPA -assisted activity,
- Have a financial interest in any contract, subcontract, or agreement with respect to a ARPA -assisted activity, or with respect to the proceeds of the ARPA -assisted activity.

Either for themselves or those with *whom they have business or immediate family ties*, during their tenure or for one year thereafter.

# **EXCEPTIONS**

Upon the written request of the recipient, Treasury may grant an exception to the provisions of this section on a case-by-case basis when it has satisfactorily met the threshold requirements below:

Treasury will consider an exception only after the recipient has provided the following documentation:

- 3. A disclosure of the nature of the conflict, accompanied by an assurance that there has been public disclosure of the conflict and description of how the public disclosure was made. AND
- 4. An opinion from the Cumberland County-Legal Department must be obtained indicating the interest for which the exception is sought would not violate State or local law.

**IMPORTANT:** Mere submission of a request for an exception does not authorize a recipient to engage in any activity or enter into any contract that constitute a conflict. An exception is not granted until the subrecipient receives such determination in writing from the County as instructed by Treasury.

In order to successfully obtain an exception from Treasury, the following points must be addressed:

• Significant cost benefit or essential expertise to the project.

- Opportunity for open competitive bidding or negotiation
- Person affected:
  - Member of low or moderate income class of persons intended to be beneficiaries of the assisted activity.
  - Exception will permit such person to receive same benefits as the class.
- Person affected has withdrawn from his or her functions or responsibilities, or the decision making process with respect to the assisted activity.
- Interest or benefit was present *before* affected person was in the conflicting position.
- Undue hardship to subrecipient or person affected which weighed against public interest served by avoiding the prohibited conflict.
- Any other relevant considerations.

# \*\* CONFLICT OF INTEREST FORMS MUST BE SIGNED BY ADMINISTRATION, STAFF AND BOARD OF DIRECTORS.

# CONFLICT OF INTEREST 2 CFR 200.112 and 2 CFR 200.318

No employee, officer or agent of Cumberland County, or its set a sides communities, subgrantee or subrecipient shall participate in selection, award or administration of contract or conduct business with a vendor if a conflict of interest, real or apparent would be involved.

- A. the employee, officer or any agent
- B. a member of his/her immediate family
- C. his or her partner
- D. an organization, which employs or is about to employ, any of the above, has financial or other interest in the firm selected for award.

Cumberland County's, sub-grantee or subrecipient, officers, employees or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from contractors, potential

# CUMBERLAND COUNTY Maine

contractors, or parties to sub-agreements, vendors or potential vendors. Depending on gravity, violation of this Conflict of Interest could result in dismissal, probation or suspension of officers, employees or agents involved or termination of contractual agreements with subrecipients.

<u>Non-disclosure Policy</u> any Cumberland County employee, sub-grantee or subrecipient shall make no disclosure of verbal or written price quotations. Violation of the nondisclosure policy shall be subject to disciplinary action as provided by the County or termination of contractual agreements when a subrecipient/sub-grantee employee is involved.

**<u>Personal Interest</u>** No member of the County Commissioners or any officer or employee of the County, sub-grantee or subrecipient shall have a financial interest, direct or indirect or by reason of ownership of stock in any corporation, in any contract or in the sale to the County of Cumberland, sub-grantee or subrecipient or to a contractor supplying the County of Cumberland, sub-grantee or subrecipient of any land or rights or interest in any land, material, supplies, or services, or in any matter in which he acts for the County of Cumberland. Any willful violation of this section shall constitute malfeasance in office, and any officer or employee of the County of Cumberland, sub-grantee or subrecipient found guilty shall there by forfeit his or her office. Any violation of this section with the knowledge, express or implied, of the person or corporation contracting with the County of Cumberland, sub-grantee or subrecipient shall render the contract void by the Compliance and Audit Director or the County Commissioners.

Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when the transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Employee Print or type Name and Position/Title

Signature

Company Name

Date

**Federal Contract Provisions** 

# <u>CERTIFICATION OF SUBCONTRACTOR REGARDING EQUAL</u> <u>EMPLOYMENT OPPORTUNITY</u>

# **Certification by Subcontractor**

Name of Subcontractor: \_\_\_\_\_

Address of Subcontractor:

Tax ID # of Subcontractor:

1. Contractor has participated in a previous contract or subcontract subject to the EEO Clause.

\_\_\_Yes \_\_\_\_No

2. Compliance reports were required to be filed in connection with such contract or subcontract.

Yes No

3. Subcontractor has filed all compliance reports due under applicable instructions, including SF-100.

\_\_\_\_Yes \_\_\_\_No

4. Have you ever been or are you being considered for sanction due to violation of Executive Order 11246, as amended? \_\_\_\_Yes \_\_\_\_No

This certification is required pursuant to Executive Order 11246 (30 F.R. 12319-25). The implementing rules and regulations provide that any contractor or prospective contractor, or any other of their proposed subcontractors, shall state as an initial part of the bid or negotiations of the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause, and if so, whether it has filed all compliance reports due under applicable instructions.

Where the certification indicates that the contractor has not filed a compliance report due under applicable instructions, such contractor shall be required to submit a compliance report within seven (7) calendar days after bid opening. No contract shall be awarded unless such report is submitted.

By signing below, you are certifying your answers to the four questions above were truthful:

Name and Title of Authorized Representative (print or type)

Signature of Authorized Representative

Date of Signature

**Federal Contract Provisions** 

# CUMBERLAND COUNTY Maine

# EQUAL EMPLOYMENT OPPORTUNITY STATEMENT

E.O. 11246 requires covered contractors and subcontractors to refrain from discrimination and to engage in affirmative steps to ensure that applicants and employees receive equal employment opportunity regardless of race, color, religion, sex, sexual orientation, gender identity, and national origin. Additionally, E.O. 11246 prohibits contractors and subcontractors from taking adverse action against employees or applicants for asking about, discussing or disclosing their pay or the pay of their co-workers.

# During the performance of this contract, the contractor agrees as follows:

- 9. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.
- 10. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- 11. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.
- 12. The contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

- 13. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 14. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 15. In the event of the contractor's non-compliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 16. The contractor will include the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: *Provided*, however, that in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

Subcontractor Signature

Date

Subcontractor Printed Name

# CUMBERLAND COUNTY Maine

#### FEDERAL REQUIREMENTS FOR SLFRF

#### 23. TITLE VI OF THE CIVIL RIGHTS ACT OF 1964

(P.L. 88-352), as amended, (42 USC 2000d) and the requirements imposed by the Regulations of the Department of Commerce (15 CFR Part 8) issued pursuant to that Title. In accordance therewith no person in the United States shall, on the grounds of race, handicap, color, sex, national origin or familial status be excluded from participation in, be denied the benefits or be otherwise subjected to discrimination under any program or activity which is paid for with federal funds. The Owner further adds that there shall not be any form of discrimination by any party in any ARPA contract on the basis of familial status, sexual orientation or sex.

#### 24. REHABILATATION ACT OF 1973

29 USC 794, Executive Order 11914, Section 504. No otherwise qualified handicapped individual shall, solely by reason of his/her handicap, be denied the benefits of, be excluded from participation in, or be subjected to discrimination under any program or activity receiving federal financial assistance.

- 25. **SECTION 202 OF EXECUTIVE ORDER 11246** Applicable to Federally assisted construction contracts and related subcontracts. During the performance of this contract, the contractor agrees as follows:
  - A. The contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of Compensation; and selection for training, including apprenticeship.
  - B. The contractor shall post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this non-discrimination clause. The Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
  - C. Contractors shall incorporate foregoing requirements in all subcontracts.
  - D. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration without regard to race, color, religion, sex, or national origin.
  - E. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided by the Contract Compliance Officer advising the said labor union or workers' representative of the contractor's commitment under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
  - F. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
  - G. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Department and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
  - H. In the event of the contractor's noncompliance with the non-discrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of

September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

- I. The contractor will include the provisions of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the Department may direct as a means of enforcing such provision, including sanctions for non-compliance. Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the Department the contractor may request the United States to enter into such litigation to protect the interest of the United States.
- J. Except as otherwise provided under <u>41 CFR Part 60</u>, all contracts that meet the definition of "federally assisted construction contract" in <u>41 CFR Part 60-1.3</u> must include the equal opportunity clause provided under <u>41 CFR 60-1.4(b)</u>, in accordance with Executive Order 11246, "Equal Employment Opportunity" (<u>30 FR 12319</u>, <u>12935</u>, <u>3 CFR Part</u>, <u>1964-1965</u> Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at <u>41 CFR part 60</u>, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor." The applicant hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on -the credit of the Federal Government pursuant to a grant, contract, loan insurance, or guarantee, or guarantee, the following equal opportunity clause:

(b)The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor; state that all qualified applicants WM receive considerations for employment without regard to race, color, religion, sex, or national origin.

(c) The contractor will send to each labor union or representative of workers. With which he has a collective bargaining agreement or other contract.

- 26. Disbarment & Suspension. Debarment and Suspension (Executive Orders 12549 and 12689) A contract award (see <u>2 CFR 180.220</u>) must not be made to parties listed on the government wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at <u>2 CFR 180</u> that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- 27. CERTIFICATION OF NONSEGREGATED FACILITIES AS REQUIRED BY THE MAY 19, 1967, ORDER (32 F.R. 74390 ON ELIMINATION OF SEGREGATED FACILITIES, BY THE SECRETARY OF LABOR. Prior to the award of any construction contract or subcontract, the Contractor shall submit signed Certification of Non-segregated Facilities Forms for him/herself and all subcontractors.

### 28. THE AGE DISCRIMINATION ACT OF 1975

No person in the United States shall, on the basis of age, be excluded from participation or be denied the benefits of, or be subjected to discrimination under, any program or activity undertaken with federal funds.

#### 29. LABOR STANDARDS

Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally

Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

- A. Specific to ARAP and when it is the sole source of federal funds, Davis Bacon is not applicable UNLESS **the total Projects cost exceed 10 Million dollars For:**
- B. recipient may provide a certification that, for the relevant project, all laborers and mechanics employed by contractors and subcontractors in the performance of such project are paid wages at rates not less than those prevailing, as determined by the U.S. Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code (commonly known as the "Davis-Bacon Act"), for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the civil subdivision of the State (or the District of Columbia) in which the work is to be performed, or by the appropriate State entity pursuant to a corollary State prevailing-wage-in-construction law (commonly known as "baby Davis-Bacon Acts"). If such certification is not provided, a recipient must provide a project employment and local impact report detailing:
  - (g) The number of employees of contractors and sub-contractors working on the project;
  - (h) The number of employees on the project hired directly and hired through a third party;
  - (i) The wages and benefits of workers on the project by classification; and
  - (j) Whether those wages are at rates less than those prevailing.
  - (k) The County must maintain sufficient records to substantiate this information upon request.
  - (l) A recipient may provide a certification that a project includes a project labor agreement, meaning a pre-hire collective bargaining agreement consistent with section 8(f) of the National Labor Relations Act (29 U.S.C. 158(f)).
- 30. Contract Work Hours and Safely Standards Act (40 U.S.C. 327-333). All laborers and mechanics employed by contractors or subcontractors shall receive overtime compensation in accordance with and subject to the provisions of the Contract Work Hours and Safety Standards Act, and the contractors and subcontractors shall comply with all regulations issued pursuant to these acts and with other applicable Federal laws and regulations pertaining to labor standards. Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.
- 31. <u>Rights to Inventions Made Under a Contract or Agreement.</u> If the Federal award meets the definition of "funding agreement" under <u>37 CFR § 401.2 (a)</u> and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment

or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of <u>37 CFR Part 401</u>, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

32. <u>Copeland Anti-Kickback Act</u> requires that workers be paid at least once a week, and without any deductions or rebates except permissible deductions. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (<u>40 U.S.C. 3145</u>), as supplemented by Department of Labor regulations (<u>29 CFR Part 3</u>, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency

# 33. SPECIAL CONDITIONS PERTAINING TO HAZARDS, SAFETY STANDARDS AND ACCIDENT PREVENTION TITLE IV OF THE LEAD BASED PAINT POISONING PREVENTION ACT

**A. Lead-Based Paint Hazards** (Applicable to contracts for construction or rehabilitation of residential structures) The construction or rehabilitation of residential structures is subject to the HUD Lead-Based Paint regulations, 24 CFR Part 35. The contractor and Subcontractors shall comply with the provisions for the elimination of lead-based paint hazards under sub-part B of said regulations. The Owner will be responsible for the inspections and certifications required under Section 35.14(f) thereof.

**B.** Use of Explosives When the use of explosives is necessary for the prosecution of the work, the Contractor shall observe all local, state and federal laws in purchasing and handling explosives. The Contractor shall take all necessary precautions to protect completed work, neighboring property, water lines, or other underground structures. Where there is danger to structures or property from blasting, the charges shall be reduced and the material shall be covered with suitable timber, steel or rope mats. The Contractor shall notify all owners of public utility property of intention to use explosives at least eight hours before blasting is done, close to such property. Any supervision of direction of use of explosives by the Engineer does not in any way reduce the responsibility of the Contractor or his Surety for damages that may be caused by such use.

**C. Danger Signals and Safely Devices** The Contractor shall make all necessary precautions to guard against damages to property and injury to persons. They shall put up and maintain in good condition, sufficient red or warning lights at night, suitable barricades and other devices necessary to protect the public. In case the Contractor fails or neglects to take such precautions, the Owner may have such lights and barricades installed and charge the cost of this work to the Contractor. Such action by the Owner does not relieve the Contractor of any liability incurred under these specifications or contract.

- 34. THE UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT OF 1970. (P.L. 91-646 as amended), 15 CFR Part 916 including amendments thereto and regulations there under, as provided by 1. M.R.SA 901 et seq. The Contractor and Grantee will ensure that all work performed under this Agreement will be done in accordance with this act.
- 35. ARCHITECTURAL BARRIERS ACT (P.L 90-480), 42 USC 4151, AS AMENDED, and the regulations issued or to be issued there under, prescribing standards for the design and construction of any building or facility intended to be accessible to the public or which may result in the employment of handicapped persons therein.
- 36. THE CLEAN AIR ACT AS AMENDED, 42 USC 1857 ED SEQ.9 THE FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED, 33 USC 1251 et seq. and the regulations of the Environmental Protection Agency with respect thereto, at 40 CFR Part 15, as amended from time to time. Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA). In no event shall any amount of the assistance provided under this Agreement be utilized with respect to a facility,

# CUMBERLAND COUNTY Maine

which has given rise to a conviction under section 113(c) (1) of the Clean Air Act or section 309(c) of the Federal Water Pollution Control Act.

- 37. **MINORITY BUSINESS ENTERPRISES** Referenced in Executive Order #11625, OMEB Circular A-102 Attachment 0 Procurement Standards. Grantees are to give priority to Minority Business Enterprises in purchase of supplies, equipment, construction, and services.
- 38. **SECTION 319 OF PUBLIC LAW 101-121**The grantee shall comply with the requirements of Section 319 of Public Law 101-121 regarding government wide restrictions on lobbying.
- 39. Byrd Anti-Lobbying Amendment (<u>31 U.S.C. 1352</u>) Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by <u>31 U.S.C.</u> <u>1352</u>. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award. See: § <u>200.323</u>. See § <u>200.216</u>. See § <u>200.322</u>. [78 FR 78608, Dec. 26, 2013, as amended at <u>79 FR 75888</u>, Dec. 19, 2014; <u>85 FR 49577</u>, Aug. 13, 2020]
- 40. **Remedial Actions**. In the event of Recipient's noncompliance with section 603 of the Act, other applicable laws, Treasury's implementing regulations, guidance, or any reporting or other program requirements, Treasury may impose additional conditions on the receipt of a subsequent tranche of future award funds, if any, or take other available remedies as set forth in 2 C.F.R. § 200.339. In the case of a violation of section 603(c) of the Act regarding the use of funds, previous payments shall be subject to recoupment as provided in section 603(e) of the Act.
- 41. **Hatch Act.** Recipient agrees to comply, as applicable, with requirements of the Hatch Act (5 U.S.C. §§ 1501-1508 and 7324-7328), which limit certain political activities of State or local government employees whose principal employment is in connection with an activity financed in whole or in part by this federal assistance.
- 42. **False Statements**. Recipient understands that making false statements or claims in connection with this award is a violation of federal law and may result in criminal, civil, or administrative sanctions, including fines, imprisonment, civil damages and penalties, debarment from participating in federal awards or contracts, and/or any other remedy available by law.
- 43. **Publications.** Any publications produced with funds from this award must display the following language: "This project [is being] [was] supported, in whole or in part, by federal award number [enter project FAIN] awarded to [name of Recipient] by the U.S. Department of the Treasury."
- 44. Debts Owed the Federal Government. Any funds paid to Recipient
  - 4. in excess of the amount to which Recipient is finally determined to be authorized to retain under the terms of this award;
  - 5. that are determined by the Treasury Office of Inspector General to have been misused; or
  - 6. that are determined by Treasury to be subject to a repayment obligation pursuant to section 603(e) of the Act and have not been repaid by Recipient shall constitute a debt to the federal government.

23. **Disclaimer.** The United States expressly disclaims any and all responsibility or liability to Recipient or third persons for the actions of Recipient or third persons resulting in death, bodily injury, property damages, or any other losses resulting in any way from the performance of this award or any other losses resulting in any way from the performance of this award. The acceptance of this award by Recipient does not in any way establish an agency relationship between the United States and Recipient.

# 24. Protections for Whistleblowers.

a. In accordance with 41 U.S.C. § 4712, Recipient may not discharge, demote, or otherwise discriminate against an employee in reprisal for disclosing to any of the list of persons or entities provided below,

information that the employee reasonably believes is evidence of gross mismanagement of a federal contract or grant, a gross waste of federal funds, an abuse of authority relating to a federal contract or grant, a substantial and specific danger to public health or safety, or a violation of law, rule, or regulation related to a federal contract (including the competition for or negotiation of a contract) or grant. b. The list of persons and entities referenced in the paragraph above includes the following:

i. A member of Congress or a representative of a committee of Congress;

ii. An Inspector General;

iii. The Government Accountability Office;

iv. A Treasury employee responsible for contract or grant oversight or management;

v. An authorized official of the Department of Justice or other law enforcement agency;

vi. A court or grand jury; or

vii. A management official or other employee of Recipient, contractor, or subcontractor who has the responsibility to investigate, discover, or address misconduct.

c. Recipient shall inform its employees in writing of the rights and remedies provided under this section, in the predominant native language of the workforce.

25. Increasing Seat Belt Use in the United States. Pursuant to Executive Order 13043, 62 FR 19217 (Apr. 18, 1997), Recipient should encourage its contractors to adopt and enforce on-the-job seat belt policies and programs for their employees when operating company-owned, rented or personally owned vehicles.

26. Reducing Text Messaging While Driving. Pursuant to Executive Order 13513, 74 FR 51225 (Oct. 6, 2009), Recipient should encourage its employees, subrecipients, and contractors to adopt and enforce policies that ban text messaging while driving, and Recipient should establish workplace safety policies to decrease accidents caused by distracted drivers.

# The Subcontractor hereby agrees, to and will comply with the terms and use of the federal program and its provisions hereto as a condition of the Bid and thereby award. The contractor acknowledges that they have read and understand said provisions hereto.

Insert Name Here:

Authorized Representative: Title: Date signed:

# SECTION 006000 - PROJECT FORMS

### 1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:
  - 1. AIA Document A101-2017 "Standard Form of Agreement between Owner and Contractor Where the Basis of Payment is a Stipulated Sum."
    - a. The General Conditions for Project are AIA Document A201-2017 "General Conditions of the Contract for Construction."
  - 2. The General Conditions are incorporated by reference.

# 1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. <u>Copies of AIA standard forms may be obtained from the American Institute of Architects;</u> www.aiacontractdocsaiacontracts.org; (800) 942-7732.
- C. Preconstruction Forms:
  - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312-2010 "Performance Bond and Payment Bond."
  - 2. Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."
- D. Payment Forms:
  - 1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."
  - 2. Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."
  - 3. Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."
  - 4. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF DOCUMENT 006000

# **AIA** Document A201° – 2017

# General Conditions of the Contract for Construction

# for the following PROJECT:

(Name and location or address)

Cumberland County Courthouse AC-1 Replacement and Controls Upgrades 142 Federal Street Portland, ME 04101

### THE OWNER:

(Name, legal status and address)

**Cumberland County Maine** 142 Federal Street Portland, ME 04101

THE ARCHITECT: (Name, legal status and address)

SMRT, Inc. 75 Washington Ave Suite 3-A Portland, ME 04101

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#### ADDITIONS AND DELETIONS:

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

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

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

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- 14 **TERMINATION OR SUSPENSION OF THE CONTRACT**
- 15 CLAIMS AND DISPUTES

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#### ARTICLE 1 **GENERAL PROVISIONS**

### § 1.1 Basic Definitions

# § 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

# § 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

# § 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

# § 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

### § 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

### § 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

### § 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

### § 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

### § 1.2 Correlation and Intent of the Contract Documents

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

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

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

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

# § 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

### § 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

# § 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203<sup>TM</sup>–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

### § 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203<sup>TM</sup>–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202<sup>TM</sup>–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

#### **ARTICLE 2** OWNER

# § 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

### § 2.3 Information and Services Required of the Owner

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

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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

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

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

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

#### § 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

#### § 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

#### **ARTICLE 3** CONTRACTOR

#### § 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

#### § 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

#### § 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

#### § 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

#### § 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

#### § 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

#### § 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

#### § 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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### § 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all .1 required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

#### § 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

#### § 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

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

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

#### § 3.11 Documents and Samples at the Site

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The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

#### § 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

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specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

#### § 3.13 Use of Site

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

#### § 3.14 Cutting and Patching

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

#### § 3.15 Cleaning Up

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

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

#### § 3.16 Access to Work

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

### § 3.17 Royalties, Patents and Copyrights

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

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#### § 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

#### ARTICLE 4 ARCHITECT

#### § 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

#### § 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

#### § 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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#### ARTICLE 5 SUBCONTRACTORS

#### § 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

#### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

#### § 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

#### § 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- assignment is effective only after termination of the Contract by the Owner for cause pursuant to .1 Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

#### **ARTICLE 6** CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

#### § 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

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

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

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

### § 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

#### § 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

#### ARTICLE 7 CHANGES IN THE WORK

#### § 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

### § 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### § 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others:
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

### § 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

#### **ARTICLE 8** TIME

#### § 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### § 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

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

#### § 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

#### **PAYMENTS AND COMPLETION** ARTICLE 9

#### § 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

#### § 9.2 Schedule of Values

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

#### § 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

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

#### § 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1: or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

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

#### § 9.5 Decisions to Withhold Certification

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§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- third party claims filed or reasonable evidence indicating probable filing of such claims, unless security .2 acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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- reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum; .4
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

#### § 9.6 Progress Payments

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§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

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

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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#### § 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

#### § 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

#### § 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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

#### § 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

#### ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

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

### § 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

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- employees on the Work and other persons who may be affected thereby; .1
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, .3 structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

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

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

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

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

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

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

### § 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

### § 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

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promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

#### § 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

#### ARTICLE 11 **INSURANCE AND BONDS**

### § 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

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or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

#### § 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

#### § 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

#### § 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### §11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

#### ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

#### § 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### § 12.2 Correction of Work

#### § 12.2.1 Before Substantial Completion

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

#### § 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

#### § 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

#### **MISCELLANEOUS PROVISIONS ARTICLE 13**

#### § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

#### § 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

#### § 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

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

#### § 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

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approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

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

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

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

#### § 13.5 Interest

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Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

#### TERMINATION OR SUSPENSION OF THE CONTRACT ARTICLE 14 § 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be .1 stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

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§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

#### § 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
  - .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
  - .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
  - .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

#### § 14.3 Suspension by the Owner for Convenience

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

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause .1 for which the Contractor is responsible; or
- that an equitable adjustment is made or denied under another provision of the Contract. .2

### § 14.4 Termination by the Owner for Convenience

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

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

- cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

#### ARTICLE 15 CLAIMS AND DISPUTES

#### § 15.1 Claims

#### § 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

### § 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

### § 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

### § 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

### § 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

### § 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

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#### § 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

#### § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

#### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

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### § 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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### PAGE 1

Cumberland County Courthouse AC-1 Replacement and Controls Upgrades 142 Federal Street Portland, ME 04101

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Cumberland County Maine 142 Federal Street Portland, ME 04101

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SMRT, Inc. 75 Washington Ave Suite 3-A Portland, ME 04101

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(Signed)		
(Title)		
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SECTION 011000 - SUMMARY

### 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. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Access to site.
  - 4. Coordination with occupants.
  - 5. Work restrictions.
  - 6. Specification and Drawing conventions.
  - 7. Miscellaneous provisions.
- B. Related Requirements:
  - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Cumberland County Courthouse- AC-1 Replacement and Controls Upgrades
  - 1. Project Location: Cumberland County Courthouse, Portland, Maine.
- B. Owner: Cumberland County Commissioners. Owner's Representative: Bill Trufant, Facilities Engineer Cumberland County Courthouse Facilities Department 142 Federal Street, Portland, Maine 04101.
- C. Architect: SMRT, 75 Washington Avenue Ste 3A, Portland ME 04101

### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. Replace the current air handler serving the ground, first, second, & third floor areas, located in the ground floor mechanical room, with a new rooftop HVAC unit.
  - 2. Construct a duct enclosure tower on the exterior of the building.
  - 3. Replace VAV boxes as noted within the associated drawings.
- B. Type of Contract:
  - 1. Project will be constructed under a single prime contract.

### 1.5 ACCESS TO SITE

- A. Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operations to locations described on the drawings.
  - 2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

### 1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
  - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
  - 3. An existing interior elevator will be available for use for construction activities. Coordinate access with the Owner prior to commencement of the Work.

#### 1.7 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
  - 2. In the event that the contractor wishes to shut down any portion of the public street or in any way impede access to adjacent facilities to facilitate rigging of equipment to the roof, the contractor shall strictly schedule this work with the City, the Owner, and Authorities Having Jurisdiction. It is preferable that such work, if required, be performed outside of normal working hours.
  - 3. For access to facility parking areas for the purpose of rigging, coordinate these activities strictly with the owner.

# B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, except as follows:

- Work may be completed during normal night shift hours, until 10:00 pm as necessary to complete the work in a timely manner. The contractor shall notify the Owner in advance of after-hours work.
- Administrative weeks will be available for work. Time shall be coordinated with the Owner.
- C. Sequence of the Work within occupied areas of the facility shall be determined during a preconstruction meeting with the Owner.
  - Courtrooms shall be closed one at a time for completion of the work therein. Coordinate work activities with the Owner prior to start of the Work.

- D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
  - 2. Obtain Owner's written permission before proceeding with disruptive operations.
  - 3. Schedule such activities to occur outside of normal working hours.
- F. Dust Control: Erect temporary partitions and plastic sheeting as required to prevent the migration of dust and construction debris to occupied areas of the facility during construction.
- G. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
  - 1. A background check will be required for ANY/ALL personnel working onsite.
  - 2. Maintain list of approved screened personnel with Owner's representative.
  - 3. Contractor badges will be provided and shall be worn in a visible location between shoulder to waist while on the jobsite.

### 1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
  - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

#### SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

#### 1.3 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time as a proposal request. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are issued only as information necessary to describe a change being considered. They are not a direction to modify the Contract or to proceed with the work as described. Do not consider them instructions either to stop work in progress or to execute the proposed change. Upon receipt, consider the schedule implications of the proposed change and immediately advise the Architect through the Construction Manager of any coordination necessary between proposed work and work in-progress. If the Owner selects to proceed with the work prior to execution of a Change Order, a written authorization will be issued.
  - 2. Within 5 business days after receipt of Proposal Request, submit a Contractor Proposal estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - A. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
- B. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- C. Include costs of labor and supervision directly attributable to the change.
- D. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals/Claims: If an Architect issued document or if latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a proposal for a change to the Architect through the Construction Manager.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: SMRT form. The form used is a combined Supplemental Instruction/ Proposal Request Form. Proceed as indicated on form. One form is used for both needs in order that the two may be tracked together.
  - 1. If a Supplemental Instruction has an impact on project cost or project schedule, proceed as indicated for a Proposal Request.

# 1.5 ALLOWANCES (AS APPLICABLE)

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance amount, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  - 1. Include installation costs in purchase amount only where indicated as part of the allowance. If not indicated, installation is not to be accounted for within the allowance value.
  - 2. Unless indicated otherwise, the allowance sum is the cost of the product delivered to the site, or if temporarily stored off-site then to that warehouse. If requested, prepare explanation and documentation to substantiate distribution of additional costs and other margins claimed.

- 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
- 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents. Submit claims within 21 days subsequent to recognition of increase. Failure to submit claim prior to material purchase may be cause for rejection of the claim.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lowerpriced materials or systems of the same scope and nature as originally indicated. Only the direct cost change will be paid.

# 1.6 UNIT COSTS (AS APPLICABLE)

A. Submit accounting for unit cost expenses as described in the specification for the unit cost. Provide documentation for quantities provided as unit cost material co-signed by the Construction Manager on the day material was delivered or placed.

#### 1.7 CHANGE ORDER PROCEDURES

- A. Upon Owner's written approval of a Contractor Proposal, Architect will issue a Change Order for signatures of Owner, Construction Manager and Contractor on AIA Document G701.
  - 1. When so indicated by the Owner, written approval of a Contractor Proposal shall be notice to proceed with a change.
  - 2. Payment for costs accrued shall be applied for only when the associated Change Order is endorsed by all parties, and the change documented in the monthly Application for Payment.

# 1.8 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: The Owner may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work or disputed work.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum. Construction Change Directive may also be used to direct the Contractor to proceed with work that is disputed as part of the original scope of work within the contract.
  - 2. In the case of a Construction Change Directive being issued where the scope of the directive will result in a Change Order to the Contract; the Construction Change Directive will only be used in the case of a threat to health and safety. Contractor shall immediately start the work upon receipt of a Construction Change Directive.

- 3. In the case of a Construction Change Directive being issued for disputed work; the Contractor shall immediately start the work upon receipt of a Construction Change Directive regardless if the work is disputed or not.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive; all Contractor Time and Material Sheets must be signed by the Construction Manager on a daily basis.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

# PART 2 - PRODUCTS (Not Used)

# PART 3 - EXECUTION

#### 3.1 DESCRIPTION

- A. Contractor shall supply sufficient supporting data to back up all costs as deemed sufficient by the Owner, Architect, and Contractor. Change Orders will not be processed until all requested information has been provided. Back-up data may include, but shall not be limited to, any tiered material/supplier detailed estimates, any tiered detailed subcontractor estimates, manufacturer statements, shipping costs, etc.
- B. Contractor shall receive 10% overhead and profit on the cost of self-performed change order work.
- C. Contractor's Subcontractors shall receive 10% overhead and profit on the cost of self-performed change order work.
- D. Contractor shall receive 5% overhead and profit on the cost of Subcontractor's work.
- E. For all Change Modifications where the Contractor is subcontracting the additional work, the overhead and profit allowed on subcontracted work shall be limited to the first tier subcontractor only.
- F. Home office administration, project management, field supervision and foreman time are considered overhead and are not allowed to be included in change modifications unless the services are specifically required to perform the additional work.

END OF SECTION 012600

#### SECTION 012900 - PAYMENT PROCEDURES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule, Submittals Schedule, and reports.

#### 1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Use form AIA G703.

- 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate.
  - a. For major work items and sub-contracts, provide separate line items for material and labor.
  - b. Within all trades scheduled for commissioning, identify a line item for commissioning equal to eight percent (8%) of the value of the work for each commissioned trade. This value will be paid as a percentage completed as commissioning progresses with not less than two percent (2%) of the value of the work held as retainage against post-occupancy commissioning.
  - c. Within trades which provide programmed electronic controls system, including but not limited to fire alarm, mechanical building management or controls, and security electronic controls systems, identify a line item for system acceptance testing equal to fifteen percent (15%) of the value of the work for each trade.
- 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 4. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 5. Include a separate line item in the Schedule of Values for submittals. Refer to Division 1 Section "Special Project Requirements".
- 6. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item within each.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
- 7. Schedule Updating: Update and resubmit the Schedule of Values before the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum. Enter all changes as new line items at the end of the Schedule of Values. Do not revise scheduled values for items of work subsequent to the initial pay application, except to further break-down a scheduled value if needed to provide more clarity.

# 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for progress payment review meetings shall be the same for each month, and shall coincide with semi-monthly site meetings to permit review of the work in-place. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets or Contractor's computerized form as approved by the Owner as form for Applications for Payment, modified to additionally provide a certification signature for the Construction

Manager. Submit quantity of certified copies of application as directed by Construction Manager.

- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Incomplete applications will be returned for completion prior to action is taken on the application.
  - 1. Entries shall match data on the Schedule of Values and Construction Schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders issued before last day of construction period covered by application.
- E. Preliminary Application: Not less than two days prior to each monthly progress meeting, submit electronic copies of the Payment Application for review and for comparison against the progress of the Work apparent on-site. The Architect will review the application against work in place and advise of necessary corrections necessary for the final application.
  - 1. Plan submission of Material Location Reports to coincide with draft Payment Application submissions.
  - 2. Plan submission of updated Project Schedules to coincide with draft Payment Application submissions.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Refer to Division 1 Section "Special Project Requirements" for limitations on payment for stored materials.
  - 2. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
  - 3. Provide supporting documentation that verifies amount requested, such as paid invoices.
  - 4. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials removed from storage (installed) after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
  - 1. Submit partial waivers on each item for amount requested before deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for the construction period preceding the current application.

- a. Submit final Application for Payment with or preceded by final waivers from every entity on the list of subcontractors, principal suppliers and fabricators. Submit the list for Owner's approval.
- 5. Waiver Forms: Submit waivers of lien on forms acceptable to the Owner.
- 6. Maintain a complete list of all subcontractors on the project and distribute to the Architect and Construction Manager.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. Schedule of Values.
  - 3. Schedule of unit prices (if applicable).
  - 4. Schedule of allowances (if applicable).
  - 5. Proposed Preliminary Construction Schedule
  - 6. Products list.
  - 7. LEED submittal for project materials cost data as applicable.
  - 8. Submittals Schedule (preliminary if not final).
  - 9. List of Contractor's staff assignments.
  - 10. Copy of building permit.
  - 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  - 12. Certificates of insurance and insurance policies.
  - 13. Performance and payment bonds.
  - 14. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
  - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  - 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
  - 1. Evidence of completion of Project closeout requirements.
  - 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  - 3. Updated final statement, accounting for final changes to the Contract Sum.
  - 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  - 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  - 6. AIA Document G707, "Consent of Surety to Final Payment."
  - 7. Lien waivers from lower tier suppliers and subcontractors.
  - 8. Evidence that claims have been settled.
  - 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

# SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

# 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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
  - 4. Requests for Interpretation (RFIs).
- B. Each contractor shall participate in coordination requirements.
- C. Related Sections include the following:
  - 1. Division 01 Section "Summary of Work" for a description of the Work of the contract.
  - 2. Division 01 Section "Project Coordination Drawings" for preparing and submitting coordination drawings.
  - 3. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractors' Construction Schedule.
  - 4. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 5. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

#### 1.4 COORDINATION

A. Coordination: General Contractor will manage multiple contractor construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. General Contractor will manage construction operations included in different Sections that depend on each other for proper installation, connection, and operation. Coordination includes the following tasks:

- 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
- 3. Make adequate provisions to accommodate items scheduled for later installation.
- 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. Administrative Procedures: General Contractor will coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractors' Construction Schedule.
  - 2. Preparation of the Schedule of Values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Pre-installation conferences.
  - 7. Project closeout activities.
  - 8. Commissioning, startup and adjustment of systems.
  - 9. Project closeout activities.
- C. Conservation: Construction activities shall be coordinated to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

# 1.5 SUBMITTALS

- A. Subcontract List: With information from each Contractor, General Contractor will prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list mailing and e mail addresses and telephone numbers including cell phone, home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
  - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

#### 1.6 PROJECT MEETINGS

- A. General: General Contractor will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Pre-construction Conference: General Contractor will schedule a pre-construction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
  - 1. Attendees: General Contractor, authorized representatives of Owner, Architect and their consultants; Contractors and its superintendents; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communication and authority.
    - f. Use of web-based Project software.
    - g. Procedures for processing field decisions and Change Orders.
    - h. Procedures for RFIs.
    - i. Procedures for testing and inspecting.
    - j. Procedures for processing Applications for Payment.
    - k. Distribution of the Contract Documents.
    - 1. Submittal procedures.
    - m. Preparation of Record Documents.
    - n. Use of the premises.
    - o. Work hours and restrictions.
    - p. Owner's occupancy requirements when applicable.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Construction waste management and recycling.
    - t. Parking availability.
    - u. Office, work, and storage areas.
    - v. Equipment deliveries and priorities.
    - w. First aid.
    - x. Security.
    - y. Progress cleaning.
  - 3. Minutes: Contractor will record and distribute meeting minutes.

- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
  - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Pre-installation conferences shall be required for the following areas of the project at a minimum:
    - a. Site work: Earthwork
    - b. Building foundations
    - c. All exterior enclosure construction that interfaces with existing building exterior enclosure construction to avoid moisture & air infiltration.
    - d. MEP Rough In
  - 3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - 1. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  - 4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 5. Reporting: General Contractor shall record and distribute minutes of the meeting to each party present and to parties who should have been present.
  - 6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

- D. Progress Meetings: General Contractor will conduct progress meetings on a biweekly basis, or at intervals as agreed among all parties. Coordinate dates of meetings with preparation of payment requests.
  - 1. Attendees: In addition to General Contractor, representatives of Owner and Architect, each Contractor, major subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractors' Construction Schedule: An updated Construction Schedule shall be presented by the Contractor reviewing progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractors' Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) RFIs.
      - 16) Status of proposal requests.
      - 17) Pending changes.
      - 18) Status of Change Orders.
      - 19) Pending claims and disputes.
      - 20) Documentation of information for payment requests.
  - 3. Minutes: The General Contractor will record and distribute the meeting minutes.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
    - a. Schedule Updating: Revise Contractors' Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: General Contractor shall conduct Contractor project coordination meetings at biweekly intervals or as agreed among all parties. Project subcontractor

coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.

- 1. Attendees: In addition to General Contractor, representatives of Contractor, major subcontractors, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
- 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Combined Contractors' Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractors' Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  - b. Schedule Updating: Revise Combined Contractors' Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
  - c. Review present and future needs of each contractor present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Resolution of coordination conflicts.
    - 4) Status of submittals.
    - 5) Deliveries.
    - 6) Off-site fabrication.
    - 7) Access.
    - 8) Site utilization.
    - 9) Temporary facilities and controls.
    - 10) Work hours.
    - 11) Safety.
    - 12) Progress cleaning.
    - 13) Quality and work standards
    - 14) RFIs.
    - 15) Change Orders.
- 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
- F. Project Closeout Conference: General Contractor will schedule and Conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
  - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  - 2. Attendees: General Contractor, authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend

the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

- 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
  - a. Preparation of record documents.
  - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
  - c. Procedures for completing and archiving we-based Project software data files.
  - d. Submittal of written warranties.
  - e. Requirements for preparing sustainable design documentation where required.
  - f. Requirements for preparing operations and maintenance data.
  - g. Requirements for delivery of maintenance stock, spare parts, and tools.
  - h. Requirements for demonstration and training.
  - i. Preparation of Contractors' punch list.
  - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - k. Submittal procedures.
  - 1. Coordination of separate contracts.
  - m. Owner's partial occupancy requirements.
  - n. Installation of Owner's furniture, fixtures, and equipment.
  - o. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

# 1.7 REQUESTS FOR INFORMATION/ INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
  - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than a Contractor will be returned with no response. All RFIs shall be submitted through the General Contractor for review, logging and distribution. Upon receipt, the Architect will review and respond to all RFIs. Responses shall be in writing and will be distributed to the General Contractor and Owner by the Architect. The General Contractor will distribute responses to Contractors.
  - 2. RFIs submitted directly to the Architect or Owner by a contractor, sub-contractor or supplier will be returned to the General Contractor with no response.
  - 3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in your work or that of others.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
  - 1. Project name.
  - 2. Date.
  - 3. Name of General Contractor.
  - 4. Name of Contractor.
  - 5. Name of Architect.
  - 6. Contractor's RFI number, numbered sequentially.
  - 7. Specification Section number and title and related paragraphs, as appropriate.

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- 8. Drawing number and detail references, as appropriate.
- 9. Field dimensions and conditions, as appropriate.
- 10. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
- 11. Contractor's signature.
- 12. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
  - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. RFIs shall be submitted electronically.
  - 1. Hard-Copy RFIs: Identify each page of attachments with the RFI number and sequential page number. Convert to PDF format for transmission.
  - 2. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow five working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. RFI responses will be provided as soon as reasonably possible, which will be dependent upon the research required.
  - 1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete, incoherent, or unnecessary RFIs, frivolous RFIs, or RFIs with numerous errors.
  - 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
  - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. On receipt of Architect's action, General Contractor will update the RFI log and immediately distribute the RFI response to affected parties. Contractors shall review response and notify General Contractor within seven days if Contractor disagrees with response.
- F. RFI Log: General Contractor will prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. The log will include the following:
  - 1. Project name.
  - 2. Name of General Contractor.
  - 3. Name of Contractor.

- 4. Name of Architect.
- 5. Contractor's RFI number.
- 6. General Contractor's RFI number including RFIs that were dropped and not submitted.
- 7. RFI description.
- 8. Date the RFI was submitted.
- 9. Date Architect's response was received.
- 10. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

# 1.8 DIGITAL PROJECT MANAGEMENT

- A. Web-Based Project Software: General Contractor will provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
  - 1. Web-based Project software site includes, at a minimum, the following features:
    - a. Compilation of Project data, including General Contractor, Contractors, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - 1. Mobile device compatibility, including smartphones and tablets.
  - 2. Provide web-based Project software user licenses for Contractors plus Owner, Commissioning Authority, Architect, and Architect's consultants.
  - 3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

# SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's Construction Schedule.
  - 2. Submittals Schedule.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
  - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
  - 3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
  - 4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.
  - 5. Division 1 Section "Closeout Procedures" for submitting photographic negatives as Project Record Documents at Project closeout.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. CPM: Critical Path Method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- G. Major Area: A story of construction, a separate building, or a similar significant construction element.
- H. Milestone: A key or critical point in time for reference or measurement.
- I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

#### 1.4 SUBMITTALS

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a graphic or spreadsheet format:
  - 1. Scheduled date for first submittal.
  - 2. Specification section numbers with title of submittals.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
  - 6. Scheduled date for Architect's final release or approval.
  - 7. Critical path date for final release and approval.
- B. Contractors' Construction Schedule: Submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

#### 1.5 QUALITY ASSURANCE

- A. Pre-scheduling Conference: Contractor will conduct a conference at Project site following start of the Work to discuss the overall project schedule and to identify critical shop drawing submittals.
  - 1. Review software limitations, content, and format for submissions.
  - 2. Discuss phasing, staging of the Work, interim milestone dates, and dates for Owner occupancy.

- 3. Review time required for production of submittals, submittal requirements and procedures, review of schedule impacts from re-submittals.
- 4. Review time required for completion and equipment startup and commissioning procedures.
- 5. Review and finalize list of construction activities to be included in schedule.
- 6. Review schedule for work of separate contracts, including work by Owner.
- 7. Review procedures for updating schedule.

#### 1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

#### PART 2 - PRODUCTS

# 2.1 SCHEDULE FORMAT

A. Submit required schedules as PDF electronic files.

#### 2.2 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals arranged in chronological order by dates required correlating with construction schedule. Include time required for review, resubmittal and second review, ordering, manufacturing, fabrication, and delivery when establishing dates.
  - 1. Coordinate Submittals Schedule with list of contractors, subcontractors, the Schedule of Values, and Contractors' Construction Schedule.
  - 2. Identify priority submittals and schedule submission first to permit processing so as to keep pace with the construction schedule.
  - 3. Group related products within a specification division that require simultaneous review.
  - 4. Group other related products within a specification division when possible.
  - 5. Distribute dates for return of submittals to match actual need, and to reasonably distribute review work load. Show float where available to permit prioritization of returns.
  - 6. Initial Submittal: Submit within three weeks of notice to proceed and prior to first submittal. Show schedule for submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 7. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

# 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

- B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Activities: Treat each building area as a separate numbered activity for each principal element of the Work.
  - 1. Activity Duration: Define activities so that no activity is longer than 30 days.
  - 2. Procurement: Include procurement process activities for long lead items and major equipment. Include submittals/resubmittals, purchasing, fabrication, delivery.
  - 3. Startup and Testing: Include realistic schedule period for start-up and testing.
  - 4. Indoor Air Quality Venting: If specified, include facility ventilation period prior to occupancy consistent with LEED EQ Credit 3.2 criteria (14,000 cubic feet/square foot floor area).
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
  - 1. Phasing: Arrange list of activities on schedule by phase.
  - 2. Work under More Than One Contract: Include a separate activity for each contract.
  - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Partial Occupancy, Substantial Completion, and Final Completion.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence within the next three weeks. Identify issues that need immediate resolution. Prepare for presentation at regular construction meetings.
- G. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

# PART 3 - EXECUTION

# 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network so that it can be accepted no later than the submission of the second Application for Payment.
  - 2. Prepare a list of all activities required to complete the Work.
    - a. Indicate the estimated time duration, sequence requirements, and relationships of each activity in relation to other activities. Include time frames for submittals,

mobilization, materials purchase, fabrication, delivery, installation, testing and commissioning, punch list inspection.

- 3. Critical Path Activities: Identify critical path activities including those for interim completion dates.
- 4. Process data to produce a computer drawn time scaled network of activities. Revise and reorganize as often as necessary to produce a schedule compliant with the Contract Time. Scheduled start and completion dates shall be consistent with the Contract dates.
- 5. Format: Locate the critical path for the project and clearly mark on the schedule, indicating which activities are on the critical path. Sub-networks for activities that are off of the critical path may be on separate pages. Indicate float for each scheduled activity at front and back of each. Highlight any activity which has zero float.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. As the Work progresses, indicate Actual Completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

#### SECTION 013300 - SUBMITTAL PROCEDURES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.
  - 2. Division 1 Section "Project Management and Coordination" for submitting Requests for Information and meeting minutes.
  - 3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractors' Construction Schedule and the Submittals Schedule.
  - 4. Division 1 Section "Quality Requirements" for submitting test and inspection reports, Delegated-Design Submittals, and for erecting mockups.
  - 5. Division 1 Section "Closeout Procedures" for submitting warranties Project Record Documents and operation and maintenance manuals.

#### 1.3 SUBMITTALS

- A. Sample Submittal: Submit first project submittal within one week of Notice to Proceed. First project submittal shall be a sample of the Contractor's submittal review incorporating the specified compliance statement. Submittal shall also demonstrate correct transmittal form, submittal format, numbering, etc. for project.
  - 1. Obtain approval of sample submittal prior to making any subsequent submittal.

#### 1.4 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action including product data submittals and shop drawings. Refer to Part 2.
- B. Informational Submittals: Written information that does not require Architect's and Construction Manager's approval such as test reports, insurance certificates, etc. Refer to Part 2. Submittals may be rejected for not complying with requirements.

# 1.5 SUBMITTAL PROCEDURES

- A. General: Architectural and engineering BIM model and CAD floor plan drawings in digital format will be provided by the Architect to Contractors requesting same in accordance with the "Authorization Statement for Electronic Transfer" form (example included). Information provided in digital format is for the sole information and use of the authorized entity or entities. Further copying or transfer of this information is prohibited by copyright.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed due to Architect's and Construction Manager's need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for schedule of submittals.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal.
  - 1. Initial Review: Schedule 21 calendar days for review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Construction Manager when a submittal being processed must be delayed for coordination. Submittal review periods will apply only with the submittal and approval of the submittal schedule.
  - 2. Resubmittal Review: Schedule 21 calendar days for review of resubmittal.
  - 3. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Drawing Identification: Place a permanent label or title block on each submittal drawing for identification.
  - 1. For drawings, provide a space approximately 4 by 8 inches (100 by 200 mm) on label or beside title block to record Contractor's, Architect's and Construction Manager's review statement and comments.
  - 2. Include the following information:
    - a. Name and address of firm or entity that prepared each submittal.
    - b. Project name.
    - c. Date.
    - d. Name and address of submitting Contractor or subcontractor.
    - e. Name and address of supplier.
    - f. Name of manufacturer.
    - g. Drawing number and detail references, as appropriate.
    - h. Other necessary identification.
- F. Deviations: Submit only specified products. Highlight, encircle, or otherwise identify minor deviations from the Contract Documents on submittals. Deviations not specifically approved and

later found to be in conflict with Contract Documents may be rejected. Refer to Division 1 Section "Product Requirements" for substitution requirements.

- G. Submittal Cover and Transmittal Form: Package each submittal for review and handling. Submittals transmitted together will be reviewed and returned together. Transmit each submittal using a transmittal cover form. Architect will return submittals received from sources other than Construction Manager without review.
  - 1. Submittal tracking number: Mark each submittal transmittal with a tracking number as follows:

25-05500-1A Resubmittal Designation. Use "A" for first resubmittal, "B" for second, etc. Submittal sequence number for Specification Section. Use a separate number for each submittal, in sequence, within each Spec. Section. (For re-submittals, repeat the designation of the original submittal.) Specification Section. Submittal Transmittal number. This number logs and tracks the numerical sequence of all submittals.

- 2. Transmittal Form: Provide the following information:
  - a. Destination (To:)
  - b. Source (From:)
  - c. Name and address of firm or entity that prepared each submittal.
  - d. Project name.
  - e. Date.
  - f. Name and address of Contractor.
  - g. Name and address of subcontractor.
  - h. Name and address of supplier.
  - i. Name of manufacturer.
  - j. Submittal tracking number.
  - k. Abbreviated submittal description. Include indication of partial submittal when applicable.
  - 1. Identification of submittal as an ACTION SUBMITTAL (requiring return) or INFORMATIONAL SUBMITTAL (requiring no return).
  - m. Remarks.
  - n. Signature of transmitter.
- 3. Record relevant information, requests for data, options for selection, revisions other than those requested by Architect on previous submittals, and all deviations proposed that represent a change from requirements of the Contract Documents including minor variations and limitations.
- 4. Include Contractor's review approval statement that information submitted complies with requirements of the Contract Documents.
- 5. Provide additional pages after transmittal form as necessary to record required information.

- H. Distribution: Construction Manager will furnish copies of returned submittals to Contractors for distribution to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only approved submittals with mark indicating action taken by Architect in connection with construction.

# PART 2 - PRODUCTS

# 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
  1. Electronic Submittals: Submit all required documents in electronic format.
  - a. Electronic information is to be presented in the same format as would be submitted in print, but as Adobe Acrobat .pdf files and formatted for printing without adjustments. Electronic submittals will be returned with comments in similar format.
    - 1) Organization: Adobe Acrobat .pdf files shall be coordinated for direct printing, with no more than one page format change within each .pdf file. Group similar sized documents for plotting to either a typical copier format sizes or to a plotter for drawing format sizes.
    - 2) Document Sizes: Documents shall conform to standard documents sizes familiar to most plotter software (Copier: 8.5" x 11", 11" x 17"// Plotter: 17" x 22", 24" x 36", 30" x 42").
    - 3) Orientation: Documents shall be oriented within the Adobe Acrobat .pdf file for machine assembly and binding without adjustment.
    - 4) File Size: Compress image files to provide appropriate resolution for use and to provide files of size that can reasonably be transmitted. Limit individual files to approximately 10 megabytes.
  - b. Color charts will not be accepted for final color selections if submitted electronically; physical samples are required.
  - c. Retain separate electronic folders of submittals as presented, and as subsequently returned for record. Refer to Division 1 Section "Project Record Documents" for record submittal requirements.
  - 2. Paper Submittals: For submittals which must be originals, submit paper copies:
    - a. Submit the number of copies of each submittal the Contractor requires plus those required for reviewers, unless otherwise indicated. Architect will retain two copies.
    - b. Mark up and retain one returned copy as a Project Record Document. Scan and file electronic copy within electronic submittal fines for project record.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.

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- b. Manufacturer's product specifications.
- c. Manufacturer's installation instructions.
- d. Standard color charts.
- e. Manufacturer's catalog cuts.
- f. Wiring diagrams showing factory-installed wiring.
- g. Printed performance curves.
- h. Operational range diagrams.
- i. Mill reports.
- j. Standard product operating and maintenance manuals.
- k. Compliance with recognized trade association standards.
- 1. Compliance with recognized testing agency standards.
- m. Application of testing agency labels and seals.
- n. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents.
  - 1. Preparation: Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shop work manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements.
    - 1. Notation of dimensions established by field measurement.
  - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1000 mm).

# D. Coordination Drawings: Comply with requirements in Division 1 Sections "Project Coordination Drawings" and "Project Management and Coordination."

- E. Samples: Prepare physical units of materials or products, including the following:
  - 1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
  - 2. Refer to Division 9 Section "Color and Finish Schedule" for color and material selections.
  - 3. Samples for Selection:
    - a. When indicated, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. Physical samples may be required for final color selection, at the Architect's discretion.
    - b. When indicated, submit full-size units or samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or

containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
  - a. Generic description of Sample.
  - b. Product name or name of manufacturer.
  - c. Sample source.
- 5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
  - a. Size limitations.
  - b. Compliance with recognized standards.
  - c. Availability.
  - d. Delivery time.
- 6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
  - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
  - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
- 7. Number of Samples for Selection: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
  - a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- 8. Disposition: Maintain sets of approved Samples at Project site, available for qualitycontrol comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- F. Mock-Ups: Erect mock-ups on-site as specified and submit a photo of the mock-up with a submittal transmittal. Architect will review mock-up on-site and return comments or approval per the procedure for a typical submittal.
  - 1. Coordinate preparation of mock-ups with regularly scheduled site meeting dates.
- G. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product.
  - 2. Number and name of room or space.
  - 3. Location within room or space.

- H. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."
- I. Contractors' Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation".
- J. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- K. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."
- L. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."
- M. Contractor & Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- N. Resubmittals: Submit whole or portions of submittals returned without approval as indicated for original submittals.

# 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
  - 1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies. For certifications, submit not less than one original signature copy.
    - a. Informational submittals, other than certifications, shall be submitted electronically as required for Action Submittals. Electronic information is to be presented in the same format as would be submitted in print, but as .pdf files and formatted for printing without adjustments.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Contractors' Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Daily Construction Reports: Submit daily construction reports on each Monday for the prior week.
- D. Material Location Reports: Submit material location reports with payment applications.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- H. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- I. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- J. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- K. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- O. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- P. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.

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SUBMITTAL PROCEDURES

- 5. Description of product.
- 6. Test procedures and results.
- 7. Limitations of use.
- Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."
- R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
  - 1. Preparation of substrates.
  - 2. Required substrate tolerances.
  - 3. Sequence of installation or erection.
  - 4. Required installation tolerances.
  - 5. Required adjustments.
  - 6. Recommendations for cleaning and protection.
- T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
  - 1. Name, address, and telephone number of factory-authorized service representative making report.
  - 2. Statement on condition of substrates and their acceptability for installation of product.
  - 3. Statement that products at Project site comply with requirements.
  - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 6. Statement whether conditions, products, and installation will affect warranty.
  - 7. Other required items indicated in individual Specification Sections.
- U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- V. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

# PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

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#### SUBMITTAL PROCEDURES

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval statement and sign before submitting to Construction Manager and Architect.
- B. Contractor's Review Statement: Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Approval statement shall be the following:

"The Contractor represents that he has determined and verified that all materials, field measurements, and field construction criteria related to this submittal are coordinated, compatible, and appropriate, and that he has checked and coordinated the information contained within this submittal with the requirements of the Work and of the Contract Documents."

2. Revise submittals which do not comply. Do not submit without approval statement.

# 3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval statement and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it with a transmittal. Architect's transmittal will record response to each submittal with an action statement to indicate action taken, as follows:
  - □ APPROVED
  - □ APPROVED AS NOTED
  - □ REJECTED
  - □ REVISE AND RESUBMIT
  - □ RESUBMIT SPECIFIED ITEM
  - □ INFORMATIONAL SUBMITTAL FOR RECORD ONLY
  - □ NO ACTION TAKEN

This review was performed for the limited purpose of determining general conformance with the design concept of the project and general compliance with the formation given in the Contract Documents. Modifications or comments made on the submittal during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. Approval of a specific item does not include approval of the assembly of which the item is a component. The Contractor is responsible for: quantities and dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction; coordination of the work of all

trades; and for performing all work in a safe and satisfactory manner.

- C. The action statement above will be appropriately marked and executed to indicate whether the submittal returned is approved for unrestricted release, final-but-restricted release, returned for resubmittal, or not approved.
  - 1. Final Unrestricted Release/Approved: When the Architect/Engineer marks a submittal or a part of a submittal "APPROVED", the Work covered by the submittal or part of a submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
  - 2. Final-But-Restricted Release/Conditionally Approved: When the Architect/Engineer marks a submittal or part of a submittal "APPROVED AS NOTED," the Work covered by the submittal or part of a submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
  - 3. Returned for Resubmittal/Not Approved: When the Architect/Engineer marks a submittal or part of a submittal "REVISE AND RESUBMIT" or "RESUBMIT SPECIFIC ITEM", do not proceed with Work covered by the submittal or part of a submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
    - a. Do not use, or allow others to use, submittals marked "REVISE AND RESUBMIT" at the Project Site or elsewhere where Work is in progress.
    - b. Marking: "RESUBMIT SPECIFIC ITEM": When a submittal or part of a submittal is marked "RESUBMIT SPECIFIC ITEM", that item shall be revised to comply with contract requirements as indicated and resubmitted.
  - 4. Not approved: When the Architect/Engineer marks a submittal or part of a submittal "REJECTED", the Work covered by the submittal or part of a submittal does not conform to the contract documents. Submittal of specified item is required prior to proceeding with Work covered by the submittal.
  - 5. "ÍNFORMATIONAL SUBMITTAL": Informational submittal items are filed for project record only. Informational submittals do not require an action, though they may cause a reaction if the information reported identifies a problem to be resolved.
  - 6. "NO ACTION TAKEN": When the Architect/Engineer marks a submittal or part of a submittal "NO ACTION TAKEN", the submittal is not required, and approval is not required. All copies may be returned with no action taken. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

# **AUTHORIZATION STATEMENT** FOR ELECTRONIC FILE TRANSFER

**b** 877.700.7678 w smrtinc.com

SMRT PROJECT NAME AND NUMBER:	Maine Correctional Center	
REQUESTED BY:		
	(company name, address)	
<b>DESCRIPTION OF SERVICE:</b> Providing pro not limited to Computer Aided Design ("	oject information in electronic format. Examples of electroni CAD") drawing digital files, and Building Information Modelir	c information include but are ng ("BIM") digital model files.

Fee Waived Hourly Rates

# TERMS AND CONDITIONS:

FEE BASIS:

\$350

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AUTHORIZATION: I/We hereby agree to the Terms and Conditions.

APPROVED/ACCEPTED BY: \_\_\_\_\_

Company Name

Representative Signature: \_\_\_\_\_ Printed name:

SMRT, INC.: Printed name:

Date: \_\_\_\_\_

#### SECTION 014000 - QUALITY REQUIREMENTS

# PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractors 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 Contractors' quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractors to provide quality-control services required by General Contractor, Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
  - 1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
  - 2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 3. Divisions 2 through 38 Sections for specific delegated design, and test and inspection requirements.

#### 1.3 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 whether completed construction complies with requirements. Services do not include contract enforcement activities performed by the General Contractor and 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. Mockups establish the standard by which the Work will be judged. Refer to Division 1 Section "Submittal Procedures" for requirements.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

# 1.4 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of a Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

## 1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.6 SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. 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.
- C. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional licensed in the project jurisdiction, for each product and system specifically assigned to a Contractor to be designed or certified by a design professional, indicating that the products and

systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

- D. Schedule of Tests and Inspections: Prepare in tabular form and submit a schedule of tests and inspections. 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.
- E. 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.
- F. 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.

# 1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work General Contractor or Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.8 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 is similar to those indicated for this Project in material, design, and extent.

- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. 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.
- H. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- I. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- J. 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 General Contractor and 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.
- K. 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 General Contractor or Architect.
  - 2. Notify General Contractor and Architect not less than seven days in advance of dates and times when mockups will be constructed by submitting a transmittal for the mock-up as a product sample submittal.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's and General Contractor's approval of mockups before starting work, fabrication, or construction. Approval will be recorded as a return submittal.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

## 1.9 QUALITY CONTROL

- A. Owner Responsibilities:
  - 1. Owner will engage a qualified independent testing agency to perform testing services.
  - 2. Payment for these services will be made by Owner through the General Contractor.
  - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to responsible Contractor without reimbursement.
- B. Contractor Responsibilities:
  - 1. For tests and inspections specified as the responsibility of the Contractor, provide these services. Engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
    - b. Payment for these services will be made by the Contractor.
  - 2. For all required tests, notify General Contractor and testing agency at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Special Tests and Inspections: Owner will engage testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
  - 1. Testing agency will notify General Contractor 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 General Contractor with copy to Architect, 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 reinspect 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. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and

conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- F. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- G. Testing Agency Responsibilities: Cooperate with General Contractor and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify General Contractor and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 3. Submit a certified written report, in triplicate, of each test, inspection, and similar quality-control service.
  - 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
  - 5. Do not perform any duties of Contractor.
- H. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify testing agency to permit coordination with the testing 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. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- I. 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.
- J. Schedule of Tests and Inspections: Assist in the General Contractor's preparation of a preliminary schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Cooperate with the testing agent to finalize scheduled testing requirements. Submit schedule within 30 days of date established for commencement of the Work.
  - 1. Distribution: General Contractor will distribute schedule to Owner, testing agencies, Contractor and each other party involved in performance of portions of the Work where tests and inspections are required.

## PART 3 - EXECUTION

#### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
  - 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

#### SECTION 014200 - REFERENCES

#### 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 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

# 1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source.

## 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up to date as of the date of the Contract Documents.
  - 1. <u>AABC Associated Air Balance Council; www.aabc.com.</u>
  - 2. <u>AAMA American Architectural Manufacturers Association; www.aamanet.org.</u>
  - 3. AAPFCO Association of American Plant Food Control Officials; www.aapfco.org.
  - 4. <u>AASHTO American Association of State Highway and Transportation Officials;</u> <u>www.transportation.org.</u>
  - 5. AATCC American Association of Textile Chemists and Colorists; www.aatcc.org.
  - 6. <u>ABMA American Bearing Manufacturers Association; www.americanbearings.org.</u>
  - 7. ABMA American Boiler Manufacturers Association; www.abma.com.
  - 8. ACI American Concrete Institute; (Formerly: ACI International); www.concrete.org
  - 9. ACPA American Concrete Pipe Association; www.concrete-pipe.org.
  - 10. AEIC Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
  - 11. AF&PA American Forest & Paper Association; www.afandpa.org.
  - 12. AGA American Gas Association; www.aga.org.
  - 13. AHAM Association of Home Appliance Manufacturers; www.aham.org.
  - 14. <u>AHRI Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.</u>
  - 15. AI Asphalt Institute; www.asphaltinstitute.org.
  - 16. <u>AIA American Institute of Architects (The); www.aia.org.</u>
  - 17. AISC American Institute of Steel Construction; www.aisc.org.
  - 18. AISI American Iron and Steel Institute; www.steel.org.
  - 19. AITC American Institute of Timber Construction; www.aitc-glulam.org.
  - 20. AMCA Air Movement and Control Association International, Inc.; www.amca.org.
  - 21. ANSI American National Standards Institute; www.ansi.org.
  - 22. AOSA Association of Official Seed Analysts, Inc.; www.aosaseed.com.
  - 23. APA APA The Engineered Wood Association; www.apawood.org.
  - 24. APA Architectural Precast Association; www.archprecast.org.
  - 25. <u>API American Petroleum Institute; www.api.org.</u>
  - 26. ARI Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 27. ARI American Refrigeration Institute; (See AHRI).

- 28. <u>ARMA Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.</u>
- 29. <u>ASCE American Society of Civil Engineers; www.asce.org.</u>
- 30. ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
- 31. <u>ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers;</u> <u>www.ashrae.org.</u>
- 32. <u>ASME ASME International; (American Society of Mechanical Engineers);</u> <u>www.asme.org.</u>
- 33. ASSE American Society of Safety Engineers (The); www.asse.org.
- 34. ASSE American Society of Sanitary Engineering; www.asse-plumbing.org.
- 35. <u>ASTM ASTM International; www.astm.org.</u>
- 36. <u>ATIS Alliance for Telecommunications Industry Solutions; www.atis.org.</u>
- 37. <u>AWEA American Wind Energy Association; www.awea.org.</u>
- 38. <u>AWI Architectural Woodwork Institute; www.awinet.org.</u>
- 39. <u>AWMAC Architectural Woodwork Manufacturers Association of Canada;</u> <u>www.awmac.com.</u>
- 40. AWPA American Wood Protection Association; www.awpa.com.
- 41. AWS American Welding Society; www.aws.org.
- 42. AWWA American Water Works Association; www.awwa.org.
- 43. BHMA Builders Hardware Manufacturers Association; www.buildershardware.com.
- 44. <u>BIA Brick Industry Association (The); www.gobrick.com.</u>
- 45. <u>BICSI BICSI, Inc.; www.bicsi.org.</u>
- 46. <u>BIFMA BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.</u>
- 47. <u>BISSC Baking Industry Sanitation Standards Committee; www.bissc.org.</u>
- 48. <u>BWF Badminton World Federation; (Formerly:</u> International Badminton Federation); www.bissc.org.
- 49. <u>CDA Copper Development Association; www.copper.org.</u>
- 50. <u>CE Conformite Europeenne; http:</u> //ec.europa.eu/growth/single-market/ce-marking/
- 51. CEA Canadian Electricity Association; www.electricity.ca.
- 52. <u>CEA Consumer Electronics Association; www.ce.org.</u>
- 53. CFFA Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
- 54. <u>CFSEI Cold-Formed Steel Engineers Institute; www.cfsei.org.</u>
- 55. CGA Compressed Gas Association; www.cganet.com.
- 56. <u>CIMA Cellulose Insulation Manufacturers Association; www.cellulose.org.</u>
- 57. CISCA Ceilings & Interior Systems Construction Association; www.cisca.org.
- 58. <u>CISPI Cast Iron Soil Pipe Institute; www.cispi.org.</u>
- 59. CLFMI Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
- 60. <u>CPA Composite Panel Association; www.pbmdf.com.</u>
- 61. <u>CRI Carpet and Rug Institute (The); www.carpet-rug.org.</u>
- 62. <u>CRRC Cool Roof Rating Council; www.coolroofs.org.</u>
- 63. CRSI Concrete Reinforcing Steel Institute; www.crsi.org.
- 64. <u>CSA Canadian Standards Association; www.csa.ca.</u>
- 65. <u>CSA CSA International; (Formerly:</u> IAS International Approval Services); www.csainternational.org.
- 66. <u>CSI Construction Specifications Institute (The); www.csinet.org.</u>
- 67. <u>CSSB Cedar Shake & Shingle Bureau; www.cedarbureau.org.</u>
- 68. <u>CTI Cooling Technology Institute; (Formerly:</u> Cooling Tower Institute); www.cti.org.
- 69. CWC Composite Wood Council; (See CPA).
- 70. DASMA Door and Access Systems Manufacturers Association; www.dasma.com.

- 71. DHI Door and Hardware Institute; www.dhi.org.
- 72. ECA Electronic Components Association; (See ECIA).
- 73. ECAMA Electronic Components Assemblies & Materials Association; (See ECIA).
- 74. ECIA Electronic Components Industry Association; www.eciaonline.org.
- 75. EIA Electronic Industries Alliance; (See TIA).
- 76. EIMA EIFS Industry Members Association; www.eima.com.
- 77. EJMA Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
- 78. ESD ESD Association; (Electrostatic Discharge Association); www.esda.org.
- 79. ESTA Entertainment Services and Technology Association; (See PLASA).
- 80. ETL Intertek (See Intertek); www.intertek.com.
- 81. EVO Efficiency Valuation Organization; www.evo-world.org.
- 82. FCI Fluid Controls Institute; www.fluidcontrolsinstitute.org.
- 83. <u>FIBA Federation Internationale de Basketball; (The International Basketball</u> Federation); www.fiba.com.
- 84. <u>FIVB Federation Internationale de Volleyball; (The International Volleyball</u> Federation); www.fivb.org.
- 85. FM Approvals FM Approvals LLC; www.fmglobal.com.
- 86. FM Global FM Global; (Formerly: FMG FM Global); www.fmglobal.com.
- 87. FRSA Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.: www.floridaroof.com.
- 88. FSA Fluid Sealing Association; www.fluidsealing.com.
- 89. <u>FSC Forest Stewardship Council U.S.; www.fscus.org.</u>
- 90. <u>GA Gypsum Association; www.gypsum.org.</u>
- 91. GANA Glass Association of North America; www.glasswebsite.com.
- 92. <u>GS Green Seal; www.greenseal.org.</u>
- 93. <u>HI Hydraulic Institute; www.pumps.org.</u>
- 94. HI/GAMA Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
- 95. HMMA Hollow Metal Manufacturers Association; (See NAAMM).
- 96. HPVA Hardwood Plywood & Veneer Association; www.hpva.org.
- 97. <u>HPW H. P. White Laboratory, Inc.; www.hpwhite.com.</u>
- 98. IAPSC International Association of Professional Security Consultants; www.iapsc.org.
- 99. IAS International Accreditation Service; www.iasonline.org.
- 100. IAS International Approval Services; (See CSA).
- 101. ICBO International Conference of Building Officials; (See ICC).
- 102. ICC International Code Council; www.iccsafe.org.
- 103. ICEA Insulated Cable Engineers Association, Inc.; www.icea.net.
- 104. ICPA International Cast Polymer Alliance; www.icpa-hq.org.
- 105. ICRI International Concrete Repair Institute, Inc.; www.icri.org.
- 106. IEC International Electrotechnical Commission; www.iec.ch.
- 107. IEEE Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
- 108. <u>IES Illuminating Engineering Society; (Formerly:</u> Illuminating Engineering Society of North America); www.ies.org.
- 109. IESNA Illuminating Engineering Society of North America; (See IES).
- 110. IEST Institute of Environmental Sciences and Technology; www.iest.org.
- 111. IGMA Insulating Glass Manufacturers Alliance; www.igmaonline.org.
- 112. <u>IGSHPA International Ground Source Heat Pump Association;</u> <u>www.igshpa.okstate.edu.</u>
- 113. ILI Indiana Limestone Institute of America, Inc.; www.iliai.com.
- 114. <u>Intertek Intertek Group; (Formerly:</u> ETL SEMCO; Intertek Testing Service NA); www.intertek.com.

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- 115. <u>ISA International Society of Automation (The); (Formerly:</u> Instrumentation, Systems, and Automation Society); www.isa.org.
- 116. ISAS Instrumentation, Systems, and Automation Society (The); (See ISA).
- 117. <u>ISFA International Surface Fabricators Association; (Formerly:</u> International Solid Surface Fabricators Association); www.isfanow.org.
- 118. ISO International Organization for Standardization; www.iso.org.
- 119. ISSFA International Solid Surface Fabricators Association; (See ISFA).
- 120. ITU International Telecommunication Union; www.itu.int/home.
- 121. KCMA Kitchen Cabinet Manufacturers Association; www.kcma.org.
- 122. LMA Laminating Materials Association; (See CPA).
- 123. LPI Lightning Protection Institute; www.lightning.org.
- 124. MBMA Metal Building Manufacturers Association; www.mbma.com.
- 125. MCA Metal Construction Association; www.metalconstruction.org.
- 126. MFMA Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
- 127. MFMA Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
- 128. MHIA Material Handling Industry of America; www.mhia.org.
- 129. MIA Marble Institute of America; www.marble-institute.com.
- 130. MMPA Moulding & Millwork Producers Association; www.wmmpa.com.
- 131. MPI Master Painters Institute; www.paintinfo.com.
- 132. <u>MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.</u>; <u>www.mss-hq.org.</u>
- 133. <u>NAAMM National Association of Architectural Metal Manufacturers;</u> www.naamm.org.
- 134. <u>NACE NACE International; (National Association of Corrosion Engineers</u> <u>International); www.nace.org.</u>
- 135. NADCA National Air Duct Cleaners Association; www.nadca.com.
- 136. NAIMA North American Insulation Manufacturers Association; www.naima.org.
- 137. NBGQA National Building Granite Quarries Association, Inc.; www.nbgqa.com.
- 138. NBI New Buildings Institute; www.newbuildings.org.
- 139. NCAA National Collegiate Athletic Association (The); www.ncaa.org.
- 140. NCMA National Concrete Masonry Association; www.ncma.org.
- 141. NEBB National Environmental Balancing Bureau; www.nebb.org.
- 142. NECA National Electrical Contractors Association; www.necanet.org.
- 143. <u>NeLMA Northeastern Lumber Manufacturers Association; www.nelma.org.</u>
- 144. NEMA National Electrical Manufacturers Association; www.nema.org.
- 145. NETA InterNational Electrical Testing Association; www.netaworld.org.
- 146. NFHS National Federation of State High School Associations; www.nfhs.org.
- 147. <u>NFPA National Fire Protection Association; www.nfpa.org.</u>
- 148. NFPA NFPA International; (See NFPA).
- 149. NFRC National Fenestration Rating Council; www.nfrc.org.
- 150. NHLA National Hardwood Lumber Association; www.nhla.com.
- 151. NLGA National Lumber Grades Authority; www.nlga.org.
- 152. NOFMA National Oak Flooring Manufacturers Association; (See NWFA).
- 153. NOMMA National Ornamental & Miscellaneous Metals Association; www.nomma.org.
- 154. NRCA National Roofing Contractors Association; www.nrca.net.
- 155. NRMCA National Ready Mixed Concrete Association; www.nrmca.org.
- 156. <u>NSF NSF International; www.nsf.org.</u>
- 157. <u>NSPE National Society of Professional Engineers; www.nspe.org.</u>
- 158. NSSGA National Stone, Sand & Gravel Association; www.nssga.org.
- 159. NTMA National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.

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- 160. <u>NWFA National Wood Flooring Association; www.nwfa.org.</u>
- 161. <u>PCI Precast/Prestressed Concrete Institute; www.pci.org.</u>
- 162. PDI Plumbing & Drainage Institute; www.pdionline.org.
- 163. <u>PLASA PLASA; (Formerly:</u> ESTA Entertainment Services and Technology Association); http
- 164. <u>RCSC Research Council on Structural Connections; www.boltcouncil.org.</u>
- 165. <u>RFCI Resilient Floor Covering Institute; www.rfci.com.</u>
- 166. <u>RIS Redwood Inspection Service; www.redwoodinspection.com.</u>
- 167. SAE SAE International; www.sae.org.
- 168. SCTE Society of Cable Telecommunications Engineers; www.scte.org.
- 169. SDI Steel Deck Institute; www.sdi.org.
- 170. SDI Steel Door Institute; www.steeldoor.org.
- 171. SEFA Scientific Equipment and Furniture Association (The); www.sefalabs.com.
- 172. SEI/ASCE Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
- 173. SIA Security Industry Association; www.siaonline.org.
- 174. SJI Steel Joist Institute; www.steeljoist.org.
- 175. SMA Screen Manufacturers Association; www.smainfo.org.
- 176. <u>SMACNA Sheet Metal and Air Conditioning Contractors' National Association;</u> www.smacna.org.
- 177. SMPTE Society of Motion Picture and Television Engineers; www.smpte.org.
- 178. <u>SPFA Spray Polyurethane Foam Alliance; www.sprayfoam.org.</u>
- 179. SPIB Southern Pine Inspection Bureau; www.spib.org.
- 180. SPRI Single Ply Roofing Industry; www.spri.org.
- 181. <u>SRCC Solar Rating & Certification Corporation; www.solar-rating.org.</u>
- 182. SSINA Specialty Steel Industry of North America; www.ssina.com.
- 183. <u>SSPC SSPC:</u> The Society for Protective Coatings; www.sspc.org.
- 184. STI Steel Tank Institute; www.steeltank.com.
- 185. SWI Steel Window Institute; www.steelwindows.com.
- 186. SWPA Submersible Wastewater Pump Association; www.swpa.org.
- 187. <u>TCA Tilt-Up Concrete Association; www.tilt-up.org.</u>
- 188. <u>TCNA Tile Council of North America, Inc.; www.tileusa.com.</u>
- 189. <u>TEMA Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.</u>
- 190. <u>TIA Telecommunications Industry Association (The); (Formerly:</u> TIA/EIA -Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
- 191. TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
- 192. TMS The Masonry Society; www.masonrysociety.org.
- 193. TPI Truss Plate Institute; www.tpinst.org.
- 194. <u>TPI Turfgrass Producers International; www.turfgrasssod.org.</u>
- 195. TRI Tile Roofing Institute; www.tileroofing.org.
- 196. <u>UL Underwriters Laboratories Inc.; http:</u> //www.ul.com.
- 197. UNI Uni-Bell PVC Pipe Association; www.uni-bell.org.
- 198. USAV USA Volleyball; www.usavolleyball.org.
- 199. <u>USGBC U.S. Green Building Council; www.usgbc.org.</u>
- 200. <u>USITT United States Institute for Theatre Technology, Inc.; www.usitt.org.</u>
- 201. WASTEC Waste Equipment Technology Association; www.wastec.org.
- 202. WCLIB West Coast Lumber Inspection Bureau; www.wclib.org.
- 203. WCMA Window Covering Manufacturers Association; www.wcmanet.org.

- 204. WDMA Window & Door Manufacturers Association; www.wdma.com.
- 205. <u>WI Woodwork Institute; www.wicnet.org.</u>
- 206. WSRCA Western States Roofing Contractors Association; www.wsrca.com.
- 207. <u>WWPA Western Wood Products Association; www.wwpa.org.</u>
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
  - 1. <u>DIN Deutsches Institut fur Normung e.V.; www.din.de.</u>
  - 2. <u>IAPMO International Association of Plumbing and Mechanical Officials;</u> <u>www.iapmo.org.</u>
  - 3. <u>ICC International Code Council; www.iccsafe.org.</u>
  - 4. <u>ICC-ES ICC Evaluation Service, LLC; www.icc-es.org.</u>
- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
  - 1. <u>COE Army Corps of Engineers; www.usace.army.mil.</u>
  - 2. <u>CPSC Consumer Product Safety Commission; www.cpsc.gov.</u>
  - 3. <u>DOC</u> Department of Commerce; National Institute of Standards and Technology; <u>www.nist.gov.</u>
  - 4. <u>DOD Department of Defense; www.quicksearch.dla.mil.</u>
  - 5. DOE Department of Energy; www.energy.gov.
  - 6. EPA Environmental Protection Agency; www.epa.gov.
  - 7. FAA Federal Aviation Administration; www.faa.gov.
  - 8. <u>FG Federal Government Publications; www.gpo.gov/fdsys.</u>
  - 9. <u>GSA General Services Administration; www.gsa.gov.</u>
  - 10. <u>HUD Department of Housing and Urban Development; www.hud.gov.</u>
  - 11. <u>LBL Lawrence Berkeley National Laboratory; Environmental Energy Technologies</u> <u>Division; www.eetd.lbl.gov.</u>
  - 12. OSHA Occupational Safety & Health Administration; www.osha.gov.
  - 13. <u>SD Department of State; www.state.gov.</u>
  - 14. <u>TRB Transportation Research Board; National Cooperative Highway Research</u> <u>Program; The National Academies; www.trb.org.</u>
  - 15. <u>USDA Department of Agriculture; Agriculture Research Service; U.S. Salinity</u> <u>Laboratory; www.ars.usda.gov.</u>
  - 16. <u>USDA Department of Agriculture; Rural Utilities Service; www.usda.gov.</u>
  - 17. <u>USDOJ Department of Justice; Office of Justice Programs; National Institute of Justice;</u> <u>www.ojp.usdoj.gov.</u>
  - 18. <u>USP U.S. Pharmacopeial Convention; www.usp.org.</u>
  - 19. <u>USPS United States Postal Service; www.usps.com.</u>
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. <u>CFR Code of Federal Regulations; Available from Government Printing Office;</u> <u>www.gpo.gov/fdsys.</u>

- 2. <u>DOD Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.</u>
- 3. DSCC Defense Supply Center Columbus; (See FS).
- 4. FED-STD Federal Standard; (See FS).
- 5. <u>FS Federal Specification; Available from DLA Document Services;</u> <u>www.quicksearch.dla.mil.</u>
  - a. Available from Defense Standardization Program; www.dsp.dla.mil.
  - b. Available from General Services Administration; www.gsa.gov.
  - c. <u>Available from National Institute of Building Sciences/Whole Building Design</u> <u>Guide; www.wbdg.org/ccb.</u>
- 6. MILSPEC Military Specification and Standards; (See DOD).
- 7. USAB United States Access Board; www.access-board.gov.
- 8. USATBCB U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

#### 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 requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for coordination with related requirements.

#### 1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- C. <u>Erosion and Sedimentation Control Plan:</u> Show compliance with requirements of current EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
  - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
  - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
  - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
  - 1. Locations of secure dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste-handling procedures.
  - 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
  - 1. Methods used to meet the goals and requirements of the Owner.
  - 2. Concrete cutting method(s) to be used.
  - 3. Location of construction devices on the site.
  - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
  - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
  - 6. Indicate locations of sensitive equipment areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

## 1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

#### 1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide rubber bases for supporting posts.
- C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.
- D. Fire-Retardant-Treated Lumber: In accordance with specification section 061000 "Rough carpentry".
- E. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flamespread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

#### 2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

- 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
- 2. Conference room of sufficient size to accommodate meetings of 14 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
- 3. Drinking water and private toilet.
- 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
- 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with fourstage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## PART 3 - EXECUTION

## 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

# 3.2 INSTALLATION, GENERAL

A. Locate facilities where acceptable with the Owner, and where they will serve Project adequately and result in minimum interference with performance of the Work and Owner's ongoing operations of the existing facility to remain. Relocate and modify facilities as required by progress of the Work.

- 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area, using HEPA-equipped airfiltration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  - 2. Maintain secure dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filterequipped vacuum equipment.

## 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with the requirements of the authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Temporary Dehumidification:
  - 1. Provide temporary dehumidification systems as follows.
    - a. When required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

- b. During application of fire resistive materials to prevent condensation on building walls, fixtures, equipment, etc., provide dehumidifiers to remove curing moisture from the air.
- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment and one land-based telephone line(s) for each field office.
  - 1. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Architect's office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

## 3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
  - 1. Provide construction for temporary field offices where indicated, that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
  - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Coordinate designated parking location with the Owner.
- D. Storage and Staging: Coordinate designated areas of Project site for storage and staging needs, with the Owner.

- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as permitted by Owner.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touch up signs, so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations, and coordinate locations with the Owner. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

## 3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations .
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Partitions: Provide secure dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
  - 1. Construct secure dustproof partitions with fire-retardant-treated plywood and as indicated on the drawings.
  - 2. Construct dustproof partitions at non-secure areas with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

- 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
- 4. Insulate partitions to control noise transmission to occupied areas.
- 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
- 6. Protect air-handling equipment.
- 7. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
  - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

## 3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard and replace stored or installed material that begins to grow mold.
  - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
  - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

## 3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

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## SECTION 016000 - PRODUCT REQUIREMENTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 1 Section "References" for applicable industry standards for products specified.
  - 2. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
  - 3. Divisions 2 through 38 Sections for specific requirements for warranties on products and installations specified to be warranted.

## 1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.
- D. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- E. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- F. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend the time limit provided by manufacturer's warranty or to provide more rights for Owner.

## 1.4 SUBMITTALS

- A. Substitution Requests: When substitutions are permitted under Part 2.2, submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form provided at end of Section.
  - 2. Documentation: Submit documentation to show compliance with requirements for substitutions, as applicable:
    - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - b. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - d. Samples, where applicable or requested.
    - e. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - f. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    - g. Product warranty with provisions meeting specification.
    - h. Certificates and qualification data, where applicable or requested.
    - i. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
  - 3. Additional Documentation: When substitutions are permitted subsequent to award under Part 2.2, submit the following additional documentation, as applicable:
    - a. Identify Owner advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Account for

revisions made necessary to the Contract Documents, changes to the indicated design result, and impacts upon other portions of the Work.

- b. Provide documentation that substitution has received necessary approvals of authorities having jurisdiction.
- c. Certify the requested substitution has been coordinated with other portions of the Work, is compatible with other products, and is acceptable to all contractors involved without a change to the Contract sum or duration.
- d. Certify substitution is presented as an alternate for a specified material or product that is not available.
- 4. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposal. Provide specified item if substitution is not accepted.
  - a. Notification for acceptance of a substitution prior to award will be provided by addendum revising Construction Documents. Refer to Bidding Instructions.

# 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 5. Store products to allow for inspection and measurement of quantity or counting of units.
  - 6. Obtain Owners written authorization to deliver highly valuable small items on-site for more than 4 weeks prior to installation. Store highly valuable small items concealed within locked rooms or containers. Store other valuable items out of sight as much as possible.
  - 7. Store materials in a manner that will not endanger Project structure.
  - 8. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

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10. Protect stored products from damage.

# 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturers' or installers' disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
  - 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Warranty Start and Finish: All project warranties shall begin on the Date of Substantial Completion for the work or equipment in question. The obligations of manufacturer or installer warranties dated with other start/completion dates shall become the responsibility of the Contractor for the remaining Contractual warranty period.
- D. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

#### PART 2 - PRODUCTS

#### 2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  - 7. Where products are specified by name, and/or accompanied by the term "or approved equal" or "or approved substitute," comply with provisions in Procedural Documents regarding the submission of substitute product data for approval.

- Product Selection Procedures: Procedures for product selection include the following: Β.
  - 1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered after award.
    - Sole product may be indicated by the phrase: "Subject to compliance with a. requirements, provide the following: ..."
  - 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered after award.
    - Sole manufacturer/source may be indicated by the phrase: "Subject to compliance a. with requirements, provide products by the following: ..."
  - 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with Comparable products or substitutions for Contractor's convenience requirements. subsequent to award will not be considered after award.
    - Limited list of products may be indicated by the phrase: "Subject to compliance with a. requirements, provide one of the following: ..."
  - 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
    - Non-limited list of products is indicated by the phrase: "Subject to compliance with a. requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
  - Limited List of Manufacturers: Where Specifications include a list of manufacturers' 5. names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience subsequent to award will not be considered after award.
    - Limited list of manufacturers is indicated by the phrase: "Subject to compliance with a. requirements, provide products by one of the following: ..."
  - Non-Limited List of Manufacturers: Where Specifications include a list of available 6. manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
    - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
  - 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections, as applicable.
- D. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's PRODUCT REQUIREMENTS 01600 - 5

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sample. Architect's decision will be final on whether a proposed product matches satisfactorily. Refer to Division 9 Section "Color and Finish Schedule" for material selections. Specific products listed shall be matched.

- 1. If no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
- E. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
  - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items. Where a manufacturer offers fewer than six standard colors, patterns, or textures, the Architect will select from manufacturer's full range of colors, patterns, textures as their standard range without limit.
  - 2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

# 2.2 PRODUCT SUBSTITUTIONS

- A. Product substitutions prior to bid: Materials shall be as specified herein, except, consideration shall be given to other products that meet or exceed the performance of those specified if documentation per this specification is submitted and received not less than five (5) business days prior to the date of bid opening. Refer to Instructions to Bidders.
- B. Product Substitutions subsequent to award: Architect will consider Contractor's request for substitution if the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Documentation is submitted per Part 1.4 of this specification.
  - 2. Requested substitution offers Owner an advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 3. Requested substitution does not require revisions to the Contract Documents.
  - 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has necessary approvals of authorities having jurisdiction as applicable.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.
  - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved without a change in the Contract sum or duration.

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11. Requested substitution is presented as an alternate for a specified material or product that is not available.

## 2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are not limited to specific products or manufacturers, submit the following, in addition to other required submittals as applicable, to obtain approval of an unnamed product:
  - 1. Product data sufficient to demonstrate that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Product data sufficient to provide comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, compliance with referenced industry standards, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.
- B. Refer to Section 013300 Submittal Requirements for additional information and requirements.

PART 3 - EXECUTION (Not Used)

#### SUBSTITUTION REQUEST FORM

Project:		Substitution Reque	est Number:	
To:		From:		
Re:		Date:		<u> </u>
Specification Title:		Description:		
Section:	Page:	Article/Paragraph:		
Proposed Substitution:				
Manufacturer:		Address:	Phone:	
Trade Name:	e Name: Model No			

Attached data includes product description, specifications, drawings, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation.

The Undersigned certifies that he or she:

- 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
- 2. Has investigated and determined that the proposed Product has received necessary approvals of authorities having jurisdiction as applicable.
- 3. Will provide the same warranty for the Substitution as for the specified Product.
- 4. Will coordinate installation and pay for associated changes to other Work made necessary due to the substitution with no additional cost to Owner.
- 5. Has accounted for all additional costs resulting from the use of substitution and will pay for all other associated costs that may subsequently become apparent.
- 6. Has verified that the project schedule will not be delayed by the provision of the substitution.

Submitted By:Signed By:Firm:Address:	 
<u>-</u> Telephone:Fax:	<u> </u>
A/E's REVIEW AND ACTIONSubmission approved - Make submittals in accordance with Specification Section 01330Submission approved as noted - Make submittals in accordance with Specification Section 01330Submission rejected - Use specified materialsSubmission request received too late - Use specified materials.	
Signed by:Date:	
Supporting Data Attached:DrawingsProduct DataSamplesTestsReports	
21254-02 PRODUCT REQUIREMENTS	01600 - 8

\_\_Other\_\_\_

# END OF SECTION 016000

Cumberland County Courthouse AC-1 Replacement and Controls Upgrades Portland, ME

# PRODUCT REQUIREMENTS
SECTION 017300 - EXECUTION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Coordination and support of other contractors hired by the Owner to install specific systems.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections include the following:
  - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  - 2. Division 1 Section "Submittal Procedures" for submitting surveys.
  - 3. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

# 1.3 SUBMITTALS

- A. Qualification Data: For professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

- 1.4 QUALITY ASSURANCE
  - A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through the Construction Manager. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on "Request for Interpretation/ Information" Form.

# 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to layout the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a professional surveyor to layout the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and layout site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and layout control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

## 3.4 FIELD ENGINEERING

- A. Identification: Identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Construction Manager and Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

## 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, conduit, and wiring in finished areas, unless otherwise indicated. Obtain written authorization to expose items prior to installation.
  - 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling. Obtain written authorization to install items below this height.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make similar joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Except where sealant or grout joints are indicated, fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

## 3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily in accordance with OSHA requirements. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

- 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

## 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

#### 3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

## 3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

## SECTION 017329 - CUTTING AND PATCHING

## 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. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
  - 1. Divisions 2 through 38 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 2. Division 07 Section "Firestopping" for patching fire-rated construction.

#### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

#### 1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio of element.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Fire-suppression systems.
  - 4. Mechanical systems piping and ducts.
  - 5. Control systems.
  - 6. Communication systems.
  - 7. Conveying systems.
  - 8. Electrical wiring systems.
  - 9. Operating systems of special construction in Division 13 Sections.

- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  - 1. Water, moisture, or vapor barriers.
  - 2. Membranes and flashings.
  - 3. Equipment supports.
  - 4. Piping, ductwork, vessels, and equipment.
  - 5. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

- 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
- 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

- 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
  - b. Restore damaged pipe covering to its original condition.
- 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## 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 administrative and procedural requirements for the following:
  - 1. Salvaging non-hazardous construction waste.
  - 2. Recycling non-hazardous construction waste.
  - 3. Disposing of non-hazardous construction waste.
- B. Related Sections include the following:
  - 1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.
  - 2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

#### 1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of construction waste and subsequent incorporation into the Work.

#### 1.4 PERFORMANCE GOALS

- A. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous construction waste as possible including the following materials:
  - 1. Construction Waste:
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- a. Site-clearing waste.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Gypsum board.
- i. Piping.
- j. Electrical conduit.

PART 2 - PRODUCTS - (Not Used)

#### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

#### 3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. Procedures:
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

# 3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees.
  - 1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

#### 3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

#### END OF SECTION 017419

## SECTION 017700 - CLOSEOUT PROCEDURES

#### 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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Division 01 Section "Execution" for progress cleaning of Project site.
  - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
  - 6. Divisions 02 through 38 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Definition: Substantial Completion is the stage in the progress of the Work when the Work or a designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.
  - 1. Incomplete Work or ongoing construction activities that obstruct or inhibit the Owner from intended use of the Work shall be cause to delay Substantial Completion.
- B. Preliminary Procedures: Before requesting inspection for determining the date of Substantial Completion, complete the following.

- 1. Complete painting, final cleaning, and the Contractor's quality assurance inspection and repair program.
- 2. Prepare a list of remaining items to be completed and corrected, the value of items on the list, and reasons why the Work is not complete.
  - a. Include commissioning agent identified items to be completed.
  - b. Identified Punch List items shall not be items which will obstruct or inhibit the Owner from intended use of the Work.
- 3. Advise Owner of pending insurance changeover requirements.
- 4. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
- 5. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- 6. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
- 7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable. Obtain written documentation of materials endorsed by Owner's representative and submit with Project Record Documents.
- 8. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
- 9. Complete startup testing of systems.
- 10. Submit test/adjust/balance records.
- 11. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- 12. Advise Owner of changeover in heat and other utilities.
- 13. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- 14. Complete final cleaning requirements, including touchup painting.
- 15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: Submit a written request for inspection for Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and. On receipt of request, the Architect will either proceed with the inspection, or will notify the Construction Manager of unfulfilled requirements which require postponement of the inspection. Architect will prepare the Certificate of Substantial Completion after inspection or will notify the Construction Manager of items, either on Construction Managers' list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
  - 1. Results of completed inspection will form the basis of requirements for Final Completion.

## 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection, complete the following:
  - 1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."

- 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Contractor. The certified copy of the list shall state that each item has been completed or otherwise identify how item was resolved for acceptance.
- 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- 4. Submit pest-control final inspection report and warranty.
- 5. Provide documentation of instruction of Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- 6. Submit demonstration and training transcription, video recordings, and attendance logs.
- 7. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance, a minimum of 10 days prior to the date the Work will be completed and ready for final inspection. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. The Architect will prepare a final Certificate for Payment after inspection or will notify the Construction Manager of items that must be completed or corrected before the certificate will be issued.
  - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

# 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order by Area Plan Designations, starting with exterior areas first.
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, doors and frames, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Include commissioning agent identified items yet to be completed.

## 1.6 WARRANTIES

- A. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period. Date warranties per Division 1 Section "Product Requirements".
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

- 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11 inch paper.
- 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
- 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- 4. Submit 3 labeled CD, DVD data discs or USB memory drives with warranty documents in Adobe PDF format. Label PDF files with document Number and Title.
- C. Warranty Electronic File: If agreed to by the Owner, the Construction Manager may provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to Architect.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

## 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project.
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

- c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
- e. Remove snow and ice to provide safe access to building.
- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- h. Sweep concrete floors broom clean in unoccupied spaces.
- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
- j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
- k. Remove labels that are not permanent.
- 1. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
  - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
- m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Replace parts subject to unusual operating conditions.
- o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- q. Clean ducts, blowers, and coils if units were operated without filters during construction.
- r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

# END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Maintenance manuals for the care and maintenance of products, materials, systems and equipment.
- B. Related Sections include the following:
  - 1. Division 1 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 1 "Closeout Procedures" for submitting operation and maintenance manuals.
  - 3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 4. Divisions 2 through 38 for specific operation and maintenance manual requirements for products in those Sections.

#### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit two (2) copies of each manual at least fifteen (15) days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory.
  - 1. Submit 3 labeled CD, DVD data discs or USB memory drives with manuals' documents in Adobe PDF format. Label PDF files with document Number and Title.

2. Refer to Division 1 Section "Demonstration and Training" for requirement that manuals be submitted and approved prior to training.

## 1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

# PART 2 - PRODUCTS

# 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## 2.2 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.

- 2. Name and address of Project.
- 3. Name and address of Owner.
- 4. Date of submittal.
- 5. Name, address, and telephone number of Construction Manager.
- 6. Name and address of Architect.
- 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents (Paper Copy): Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
  - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  - 4. Supplementary Text: Prepared on 8-1/2-by-11-inchwhite bond paper.
  - 5. Drawings: Laminate drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Manual Contents (Electronic Files): Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

## 2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions.
  - 2. Performance and design criteria if Construction Manager is delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.

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- 5. Operating logs.
- 6. Wiring diagrams.
- 7. Control diagrams.
- 8. Piped system diagrams.
- 9. Precautions against improper use.
- 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.
  - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
  - 1. Startup procedures.
  - 2. Equipment or system break-in procedures.
  - 3. Routine and normal operating instructions.
  - 4. Regulation and control procedures.
  - 5. Instructions on stopping.
  - 6. Normal shutdown instructions.
  - 7. Seasonal and weekend operating instructions.
  - 8. Required sequences for electric or electronic systems.
  - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:

- 1. Product name and model number.
- 2. Manufacturer's name.
- 3. Color, pattern, and texture.
- 4. Material and chemical composition.
- 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

#### 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard printed maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

- 5. Aligning, adjusting, and checking instructions.
- 6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
  - 1. Include list of recommended stock replacement parts for Owner inventory.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

## 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- G. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

#### 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. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
  - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

#### 1.3 SUBMITTALS

- A. General: Record documents indicated below may be submitted together on USB digital media provided that three complete drives are provided with complete matching documents.
- B. Record Drawings: Comply with the following:
  - 1. Initial Submittal: Submit one set(s) half-size of marked-up Record Drawings. Print each drawing, whether or not changes and additional information were recorded. Architect will review and mark whether general scope of changes recorded is acceptable. Architect will return prints for organizing into sets for printing, binding and final submittal.
  - 2. Final Submittal
    - a. Reproduce and submit one full size bound set and one half-size bound set of Record Drawing. Plot and print each Drawing, whether or not changes and additional information were recorded. Bind half size set with a durable front and back cover and binding. Submit full size set unbound.
  - 3. Submit 3 labeled CD, DVD data discs or USB memory drives with Drawings in Adobe PDF format and in AutoCAD or Revit 2016. Label PDF files with document Number and Title.

- C. Record Specifications:
  - 1. Submit Project's Specifications, including addenda and contract modifications marked or edited into specs.
  - 2. Submit 3 labeled CD, DVD or USB memory drives with Project's Specifications, including addenda and contract modifications marked or edited into specs, all in Adobe PDF format. Label files with specifications by division or section numbers and headings.
- D. Record Product Data: Submit each Product Data submittal in Adobe PDF format.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
  - 2. Submit 3 labeled CD, DVD data discs or USB memory drives with Product Data documents in Adobe PDF format. Label PDF files with document Number and Title.
- E. Record Communications: Submit all Record Communications in Adobe PDF format.
  - 1. Submit 3 labeled CD, DVD data discs or USB memory drives with communications documents in Adobe PDF format. Provide separate files for different types of communications and include all attachments.
  - 2. Include Supplemental Instructions/ Proposal Requests, Proposals, Change Orders, Requests-for-Information, Letters, Claims, Meeting Notes, etc.

## PART 2 - PRODUCTS

#### 2.1 RECORD DRAWINGS

- A. Record Drawings: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings current at the project site to be the project Record Drawings.
  - 1. Architect Issued Drawings: Architect will issue full scale PDF drawing sheets for Supplemental Instructions. Maintain project Record Drawing set current by inserting or replacing drawing sheets as issued/approved by Change Order. Transfer site marked documentation to most current issued drawing sheet at time of insertion into construction Record Drawings set.
  - 2. Preparation: Mark Record Drawings to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Drawings.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  - 3. Content: If applicable, types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.

- c. Depths of foundations below first floor.
- d. Locations and depths of underground utilities.
- e. Revisions to routing of piping and conduits.
- f. Revisions to electrical circuitry.
- g. Actual equipment locations.
- h. Duct size and routing.
- i. Locations of concealed internal utilities.
- j. Changes made by Change Order or Construction Change Directive.
- k. Changes made following Architect's written orders.
- 1. Details not on the original Contract Drawings.
- m. Field records for variable and concealed conditions.
- n. Record information on the Work that is shown only schematically.
- 4. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
- 5. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 6. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 7. Note Supplemental Instruction, Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable. Where sketches are issued to illustrate a clarification in the work, it is acceptable to paste applicable drawings onto a blank drawing sheet within the Record Drawings.
- B. Format: Identify and date each Record Drawing page; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  - 1. Record Drawings: Organize Record Drawings into manageable sets. Include identification on cover sheets.
  - 2. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Construction Manager where applicable.
    - e. Name of Contractor.
  - 3. Scan drawings to create Adobe Acrobat PDF files for each drawing sheet.

#### 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications manually or electronically (PDF) to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected. Contractor option: Markings and revisions may be done within PDF electronic version of specifications provided markings are differentiated from original text.

- 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
- 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data by crossreference.
- 5. Note related Change Orders and Supplemental Instructions and Record Drawings where applicable.
- 6. Scan record specifications to create Adobe Acrobat PDF files for each specification with file names matching specification titles. Record Specifications marked in PDF format can be submitted directly.

## 2.3 RECORD PRODUCT DATA (MANUFACTURER PROVIDED)

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
  - 4. Organize product data by division number.
  - 5. Do not include material samples.

# PART 3 - EXECUTION

## 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

## END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

## 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. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.
- B. Related Sections include the following:
  - 1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
  - 2. Division 01 "Operation and Maintenance Data" for manuals.
  - 3. Divisions 02 through 34 Sections for specific requirements for demonstration and training for products in those Sections.

#### 1.3 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. At completion of training, submit two complete training manual(s) for Owner's use including attendance record, evaluations, video recordings, transcript with digital format copies of all material included.
  - 2. Submit digital format copies on 3 labeled CD, DVD data discs or USB memory drives in Adobe PDF format. Label PDF files with descriptive titles.
- B. Attendance Record: For each training module, submit dated list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

- D. Demonstration and Training Video Recordings: Submit three copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of photographer.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Date DVD was recorded.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - 2. Transcripts: Provide one copy prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders plus 3 digital format copies. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of video recording on each page.

# 1.4 QUALITY ASSURANCE

- A. Commissioning Agent's Role (If applicable): Acting as the Owner's agent, the commissioning agent will review and comment on all training related submittals required by this section. Submittals will also be reviewed by the Architect and Engineer. The commissioning agent will attend the pre-instruction conference and attend all training sessions provided by the contractors, acting as the Owner's agent to ensure the training sessions are comprehensive, clearly presented, and effective.
- B. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- C. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- D. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
  - 5. Identify qualified photographer responsible for video recording training sessions. Verify that video recording equipment to be utilized is capable of recording presentation under intended lighting and acoustic conditions of training room or area. Revise equipment or location of training if video or sound recording will not be clear. If recording is to be

within mechanical equipment room, coordinate session with equipment operation to turnoff noisy equipment not involved in the training session.

#### 1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations and availability of Owner's staff to attend training sessions. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

#### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - 1. Refrigeration systems, including chillers, pumps and distribution piping.
  - 2. HVAC systems, including air-handling equipment, rooftop equipment, air distribution systems and terminal equipment and devices.
  - 3. HVAC instrumentation and controls.
  - 4. HVAC temperature control system.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project Record Documents.
    - e. Identification systems.

4.

- f. Warranties and bonds.
- g. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
  - a. Instructions on meaning of warnings, trouble indications, and error messages.
  - b. Instructions on stopping.
  - c. Shutdown instructions for each type of emergency.
  - d. Operating instructions for conditions outside of normal operating limits.
  - e. Sequences for electric or electronic systems.
  - f. Special operating instructions and procedures.
  - Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Seasonal and weekend operating instructions.
    - 1. Required sequences for electric or electronic systems.
    - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

#### 3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner's Representative through Construction Manager with at least seven days' advance notice.
- C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDING

- A. General: Engage a qualified commercial photographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
  - 2. Include still images of graphic presentation materials or computer monitor views shown as a component of the training.
- B. Video Format: Provide high-quality digital color recordings.
- C. Classroom: Select classroom setting suitable for the number of participants, for clear acoustic recording of the training speaker, and with appropriate lighting. Provide as many microphones and portable lighting as required to assure successful results.
- D. Recording: Mount digital camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time. Utilize video editing software to insert still images of graphic material when presented within the timeline.
- 1. Re-record instruction sessions without trainee participants if recording is dark or sound quality is insufficient for reasonable use in training future personnel.
- E. Narration: Add description of items being viewed to supplement lectures as required to permit those viewing the recording to understand equipment, materials, or to orient themselves. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- F. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from digital file opposite the corresponding narration segment.

END OF SECTION 017900

### SECTION 024119 - SELECTIVE DEMOLITION

#### 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. Demolition and removal of selected portions of building or structure.
  - 2. Salvage of existing items to be reused or recycled.
  - 3. Patching of existing materials.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse .
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.

### 1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

#### 1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before selective demolition, Owner will remove the following items:
    - a. Those items identified by the Owner .
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.8 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.
  - 1. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

## PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video .

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

## 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Coordinate all utility shut offs with owner.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

## 3.3 **PROTECTION**

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.

- 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.
- D. Dust Protection: Specific options for dust protection include:
  - 1. Specify access routes for equipment and personnel and removal routes for selective demolition debris to areas outside the building; use sealed transport containers in corridors.
  - 2. Clean and treat duct interiors with antifungal and antiviral agents after selective demolition is complete.

## 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 2. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain fire watch during and for at least four hours after flame-cutting operations.
  - 6. Maintain adequate ventilation when using cutting torches.
  - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 10. Dispose of demolished items and materials promptly.
    - a. Comply with requirements in Section 015050 "Construction Waste Management and Disposal."

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
  - 1. Store items in a secure area until delivery to Owner.
  - 2. Transport items to Owner's storage area designated by Owner .
  - 3. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Protect items from damage during transport and storage.
  - 3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

# 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

# 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

## 3.7 PATCHING

A. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as

judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

- 1. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
- 2. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance
  - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
- 3. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

#### 3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

## END OF SECTION 024119

SECTION 032000 - CONCRETE REINFORCING

### 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. Steel reinforcement bars.
  - 2. Welded-wire reinforcement.
- B. Related Requirements:
  - 1. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction contraction and isolation joints.
    - c. Steel-reinforcement installation.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Each type of steel reinforcement.
  - 2. Bar supports.
  - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
  - 1. Include placing drawings that detail fabrication, bending, and placement.
  - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of

mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
  - 1. Location of construction joints is subject to approval of the Architect.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
  - 1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M
- B. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Steel Reinforcement:
    - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
  - 2. Mechanical splice couplers.
- C. Field quality-control reports.
- D. Minutes of preinstallation conference.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
  - 1. Store reinforcement to avoid contact with earth.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

### 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.
- E. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from asdrawn steel wire into flat sheets.

#### 2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: ACI 318 Type 1 Type 2, same material of reinforcing bar being spliced; tension-compression type.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
  - 1. Finish: Plain.

#### 2.4 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

#### 3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
  - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
  - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
  - 2. Stagger splices in accordance with ACI 318.
  - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
  - 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
  - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
  - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
  - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  - 4. Lace overlaps with wire.

## 3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement.
  - 2. Continue reinforcement across construction joints unless otherwise indicated.
  - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

## 3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

## 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Steel-reinforcement placement.
  - 2. Steel-reinforcement mechanical splice couplers.
  - 3. Steel-reinforcement welding.
- D. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

## END OF SECTION 032000

## SECTION 033000 - CAST-IN-PLACE CONCRETE

#### 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. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
  - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
  - 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. 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 mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.

- 2. Review the following:
  - a. Special inspection and testing and inspecting agency procedures for field quality control.
  - b. Construction joints, control joints, isolation joints, and joint-filler strips.
  - c. Semirigid joint fillers.
  - d. Vapor-retarder installation.
  - e. Anchor rod and anchorage device installation tolerances.
  - f. Cold and hot weather concreting procedures.
  - g. Concrete finishes and finishing.
  - h. Curing procedures.
  - i. Forms and form-removal limitations.
  - j. Shoring and reshoring procedures.
  - k. Methods for achieving specified floor and slab flatness and levelness.
  - 1. Floor and slab flatness and levelness measurements.
  - m. Concrete repair procedures.
  - n. Concrete protection.
  - o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
  - p. Protection of field cured field test cylinders.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following.
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Slag cement.
  - 4. Aggregates.
  - 5. Admixtures:
    - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
  - 6. Color pigments.
  - 7. Vapor retarders.
  - 8. Floor and slab treatments.
  - 9. Liquid floor treatments.
  - 10. Curing materials.
    - a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
  - 11. Joint fillers.
  - 12. Repair materials.

- B. Design Mixtures: For each concrete mixture, include the following:
  - 1. Mixture identification.
  - 2. Minimum 28-day compressive strength.
  - 3. Durability exposure class.
  - 4. Maximum w/cm.
  - 5. Calculated equilibrium unit weight, for lightweight concrete.
  - 6. Slump limit.
  - 7. Air content.
  - 8. Nominal maximum aggregate size.
  - 9. Steel-fiber reinforcement content.
  - 10. Synthetic micro-fiber content.
  - 11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
  - 12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
  - 13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
  - 14. Intended placement method.
  - 15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
  - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
  - 1. Concrete Class designation.
  - 2. Location within Project.
  - 3. Exposure Class designation.
  - 4. Formed Surface Finish designation and final finish.
  - 5. Final finish for floors.
  - 6. Curing process.
  - 7. Floor treatment if any.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
  - 1. Installer: Include copies of applicable ACI certificates.
  - 2. Ready-mixed concrete manufacturer.
  - 3. Testing agency: Include copies of applicable ACI certificates.

- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Fiber reinforcement.
  - 4. Curing compounds.
  - 5. Floor and slab treatments.
  - 6. Bonding agents.
  - 7. Adhesives.
  - 8. Vapor retarders.
  - 9. Semirigid joint filler.
  - 10. Joint-filler strips.
  - 11. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Slag cement.
  - 4. Aggregates.
  - 5. Admixtures:
    - a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.
- D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- E. Research Reports:
  - 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
  - 2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.
- F. Preconstruction Test Reports: For each mix design.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.
  - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
  - 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Field Quality Control Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

## 1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
  - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 3. Do not use frozen materials or materials containing ice or snow.
  - 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
  - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## 1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301unless modified by requirements in the Contract Documents.

## 2.2 CONCRETE MATERIALS

- A. Source Limitations:
  - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
  - 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
  - 3. Obtain aggregate from single source.
  - 4. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M, Type II,.
  - 2. Fly Ash: ASTM C618, Class C or F.
  - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
  - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 120.
    - a. At the contractor's option, slag cement may be blended with type II cement to modify specific properties of the concrete. The percentage of slag cement recommended by the supplier shall be approved by the Engineer.
    - b. At the supplier's option, slag cement may be blended with type II cement to achieve the performance of 0.60% alkali. The cement supplier shall provide a letter certifying the percentage of slag cement required to achieve the performance of low alkali cement specified.
    - c. May be used in foundation walls and footings. Not allowed for use in interior slabs-on-grade mixes.
- C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.

- 1. Alkali-Silica Reaction: Comply with one of the following:
  - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
  - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
  - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
- 2. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
- 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C330/C330M, 3/4-inch nominal maximum aggregate size.
- E. Air-Entraining Admixture: ASTM C260/C260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
  - 7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.
- G. Water and Water Used to Make Ice: ASTM C94/C94M, potable

## 2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

## 2.4 WATERSTOPS

A. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete. Parastop II by Paramount Technical Products, Inc. or approved equal.

## 2.5 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

## 2.6 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
  - 1. Color:
    - a. Ambient Temperature Below 50 deg F: Black.
    - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
    - c. Ambient Temperature Above 85 deg F: White.
- D. Curing Paper: Eight-feet- wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- E. Water: Potable or complying with ASTM C1602/C1602M.
- F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
- G. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

## 2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

- 1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Floor Slab Protective Covering: Eight-feet- wide cellulose fabric.

## 2.8 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

## 2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
  - 2. Slag Cement: 50 percent by mass.

- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
  - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for parking structure slabs, and concrete with a w/cm below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
  - 5. Use permeability-reducing admixture in concrete mixtures where indicated.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

#### 2.10 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for grade beams and tie beams.
  - 1. Maximum w/cm: 0.49.
  - 2. Slump Limit: 5 inches, plus or minus 1 inch.
  - 3. Air Content:
    - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
- B. Class B: Normal-weight concrete used for foundation walls.
  - 1. Minimum Compressive Strength: 4500 psi at 28 days.
  - 2. Maximum w/cm: 0.45.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
  - 4. Air Content:
    - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size.
- C. Class C: Normal-weight concrete used for interior slabs-on-ground.
  - 1. Minimum Compressive Strength: 4000 psi at 28 days.
  - 2. Maximum w/cm: 0.45.
  - 3. Minimum Cementitious Materials Content: 540 lb/cu. yd..
  - 4. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
  - 5. Air Content:
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

- D. Class D: Normal-weight concrete used for interior suspended slabs.
  - 1. Minimum Compressive Strength: 4000 psi at 28 days.
  - 2. Maximum w/cm: 0.45.
  - 3. Minimum Cementitious Materials Content: 540 lb/cu. yd..
  - 4. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
  - 5. Air Content:
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verification of Conditions:
  - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

- 1. Daily access to the Work.
- 2. Incidental labor and facilities necessary to facilitate tests and inspections.
- 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
- 4. Security and protection for test samples and for testing and inspection equipment at Project site.

## 3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
  - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

## 3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
  - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  - 7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

## 3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

- 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
- 2. Place joints perpendicular to main reinforcement.
  - a. Continue reinforcement across construction joints unless otherwise indicated.
  - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
- 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
- 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
- 6. Space vertical joints in walls at 30 feet on center. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
- 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
  - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

## 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
  - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
  - 1. If a section cannot be placed continuously, provide construction joints as indicated.
  - 2. Deposit concrete to avoid segregation.
  - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

- 1. Do not place concrete floors and slabs in a checkerboard sequence.
- 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
- 3. Maintain reinforcement in position on chairs during concrete placement.
- 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
- 5. Level concrete, cut high areas, and fill low areas.
- 6. Slope surfaces uniformly to drains where required.
- 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
- 8. Do not further disturb slab surfaces before starting finishing operations.

## 3.7 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
  - 1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
    - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    - b. Remove projections larger than 1 inch.
    - c. Tie holes do not require patching.
    - d. Surface Tolerance: ACI 117 Class D.
    - e. Apply to concrete surfaces not exposed to public view.
  - 2. ACI 301Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
    - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    - b. Remove projections larger than 1/4 inch.
    - c. Patch tie holes.
    - d. Surface Tolerance: ACI 117 Class B.
    - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
  - 3. ACI 301 Surface Finish SF-3.0:
    - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    - b. Remove projections larger than 1/8 inch.
    - c. Patch tie holes.
    - d. Surface Tolerance: ACI 117 Class A.
    - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

- B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:
  - 1. Smooth-Rubbed Finish:
    - a. Perform no later than one day after form removal.
    - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
    - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the inplace concrete.
    - d. Maintain required patterns or variances .
  - 2. Grout-Cleaned Rubbed Finish:
    - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
    - b. Do not clean concrete surfaces as Work progresses.
    - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
    - d. Wet concrete surfaces.
    - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
    - f. Maintain required patterns or variances
  - 3. Cork-Floated Finish:
    - a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
    - b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
    - c. Wet concrete surfaces.
    - d. Compress grout into voids by grinding surface.
    - e. In a swirling motion, finish surface with a cork float.
    - f. Maintain required patterns or variances
  - 4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi, apply scrubbed finish.
    - a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
    - b. Rinse scrubbed surfaces with clean water.
    - c. Maintain continuity of finish on each surface or area of Work.
    - d. Remove only enough concrete mortar from surfaces to match design reference sample.

- C. Related Unformed Surfaces:
  - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
  - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

## 3.8 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
  - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
  - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
  - 3. Apply scratch finish to surfaces to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish:
  - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
  - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
  - 3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish:
  - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
  - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
  - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 4. Do not add water to concrete surface.
  - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
  - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:

- 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- 2) Specified overall values of flatness,  $F_F 25$ ; and of levelness,  $F_L 20$ ; with minimum local values of flatness,  $F_F 17$ ; and of levelness,  $F_L 15$ .
- 3) Specified overall values of flatness,  $F_F 35$ ; and of levelness,  $F_L 25$ ; with minimum local values of flatness,  $F_F 24$ ; and of levelness,  $F_L 17$ .
- 4) Specified overall values of flatness,  $F_F 45$ ; and of levelness,  $F_L 35$ ; with minimum local values of flatness,  $F_F 30$ ; and of levelness,  $F_L 24$ .
- 5) Specified Overall Value (SOV):  $F_F$  50 and  $F_L$  25 with minimum local value (MLV):  $F_F$  40 and  $F_L$  17.
- 6) Specified Overall Value (SOV):  $F_F 25$  and  $F_L 20$  with minimum local value (MLV):  $F_F 17$  and  $F_L 15$ .
- b. Suspended Slabs:
  - 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
  - 2) Specified overall values of flatness,  $F_F 25$ ; and of levelness,  $F_L 20$ ; with minimum local values of flatness,  $F_F 17$ ; and of levelness,  $F_L 15$ .
  - 3) Specified overall values of flatness,  $F_F 35$ ; and of levelness,  $F_L 20$ ; with minimum local values of flatness,  $F_F 24$ ; and of levelness,  $F_L 15$ .
  - 4) Specified overall values of flatness,  $F_F 45$ ; and of levelness,  $F_L 35$ ; with minimum local values of flatness,  $F_F 30$ ; and of levelness,  $F_L 24$ .
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
  - 1. Coordinate required final finish with Architect before application.
  - 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
  - 2. Coordinate required final finish with Architect before application.

## 3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
  - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
  - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.

- 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: 4000 psi at 28 days. (Class C Mix)
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  - 6. Prior to pouring concrete, place and secure anchorage devices.
    - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    - b. Cast anchor-bolt insert into bases.
    - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

#### 3.10 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  - 3. If forms remain during curing period, moist cure after loosening forms.
  - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

- a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
- b. Continuous Sprinkling: Maintain concrete surface continuously wet.
- c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
- d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
- e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
  - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Begin curing immediately after finishing concrete.
  - 2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        - a) Lap edges and ends of absorptive cover not less than 12-inches.
        - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
      - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - b) Cure for not less than seven days.
      - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
        - a) Water.
        - b) Continuous water-fog spray.
    - b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

- 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - a) Lap edges and ends of absorptive cover not less than 12 inches.
  - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
- 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moistureretaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
  - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
  - b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
  - a) Water.
  - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
  - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
    - a) Lap edges and ends of absorptive cover not less than 12 inches.
    - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
  - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
    - a) Water.
    - b) Continuous water-fog spray.
- d. Floors to Receive Chemical Stain:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
  - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
  - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
  - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.

- e. Floors to Receive Urethane Flooring:
  - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
  - 2) Rewet absorptive cover and cover immediately with polyethylene moistureretaining cover with edges lapped 6 inches and sealed in place.
  - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
  - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors to Receive Curing Compound:
  - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- g. Floors to Receive Curing and Sealing Compound:
  - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

## 3.11 TOLERANCES

A. Conform to ACI 117.

# 3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
  - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Do not apply to concrete that is less than 28 days' old.
  - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
  - 4. Rinse with water; remove excess material until surface is dry.
  - 5. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

## 3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s).
  - 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

## 3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
  - 1. Repair and patch defective areas when approved by Architect.
  - 2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
    - a. Limit cut depth to 3/4 inch.
    - b. Make edges of cuts perpendicular to concrete surface.
    - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    - d. Fill and compact with patching mortar before bonding agent has dried.
    - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
    - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
- b. Compact mortar in place and strike off slightly higher than surrounding surface.
- 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
  - 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
    - a. Correct low and high areas.
    - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 3. After concrete has cured at least 14 days, correct high areas by grinding.
  - 4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
    - a. Finish repaired areas to blend into adjacent concrete.
  - 5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
    - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    - b. Feather edges to match adjacent floor elevations.
  - 6. Correct other low areas scheduled to remain exposed with repair topping.
    - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  - 7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
    - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    - d. Place, compact, and finish to blend with adjacent finished concrete.
    - e. Cure in same manner as adjacent concrete.

- 8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
  - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - b. Dampen cleaned concrete surfaces and apply bonding agent.
  - c. Place patching mortar before bonding agent has dried.
  - d. Compact patching mortar and finish to match adjacent concrete.
  - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
  - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - 1) Project name.
      - 2) Name of testing agency.
      - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      - 4) Name of concrete manufacturer.
      - 5) Date and time of inspection, sampling, and field testing.
      - 6) Date and time of concrete placement.
      - 7) Location in Work of concrete represented by samples.
      - 8) Date and time sample was obtained.
      - 9) Truck and batch ticket numbers.
      - 10) Design compressive strength at 28 days.
      - 11) Concrete mixture designation, proportions, and materials.
      - 12) Field test results.

- 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
- 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
  - 1. Headed bolts and studs.
  - 2. Verification of use of required design mixture.
  - 3. Concrete placement, including conveying and depositing.
  - 4. Curing procedures and maintenance of curing temperature.
  - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
  - 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C143/C143M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

- 5. Compression Test Specimens: ASTM C31/C31M:
  - a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
- 6. Compressive-Strength Tests: ASTM C39/C39M.
  - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
  - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
  - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 7. When strength of field-cured cylinders is less than 85 percent of companion laboratorycured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
- 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 10. Additional Tests:
  - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
  - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
    - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
- 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 after 28 days of completion of floor finishing and promptly report test results to Architect.

### 3.16 **PROTECTION**

- A. Protect concrete surfaces as follows:
  - 1. Protect from petroleum stains.
  - 2. Diaper hydraulic equipment used over concrete surfaces.
  - 3. Prohibit vehicles from interior concrete slabs.
  - 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
  - 5. Prohibit placement of steel items on concrete surfaces.
  - 6. Prohibit use of acids or acidic detergents over concrete surfaces.
  - 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
  - 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

### SECTION 044220 - STONE CLADDING PANELS

### 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 stone cladding system.
  - 2. Metal framing support system.
  - 3. Flashing and trim integral stone cladding system.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry" for wood blocking.
  - 2. Section 061600 "Sheathing" for exterior sheathing.
  - 3. Section 072500 "Weather Barriers" for weather-resistive barriers.

#### 1.3 REFERENCES

- A. ASTM B 221 Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.
- B. ASTM D 897 Standard Test Method for Tensile Properties of Adhesive Bonds.
- C. ASTM D 1761 Standard Test Method for Mechanical Fasteners in Wood.
- D. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E 283 Standard Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors.
- F. ASTM E 330 Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors under the Influence of Wind Loads.
- G. ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- H. ASTM E 1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

# 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, stone cladding panel system Installer, stone cladding panel system manufacturer's representative, and installers whose work interfaces with or affects stone cladding panels,
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to stone cladding panel system installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect stone cladding panel system.
  - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 7. Review temporary protection requirements for system assembly during and after installation.
  - 8. Review procedures for repair of panels damaged after installation.
  - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

# 1.5 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- B. Shop Drawings: Include plans, elevations, and details, size and layout of panels, trim, accessories, supports, and attachments.
  - 1. Show locations, mounting details and details of joints both within honeycomb-backed stone cladding assembly and between stone panel cladding assembly and other construction.
  - 2. Include details of all varying joints, anchorage, corners, direction changes and connection to other materials.
  - 3. Show locations and details of channel system.
  - 4. Show direction of veining, grain, or other directional pattern.
  - 5. Include large-scale elevations of each building elevation with each panel numbered and dimensioned

# 1.6 INFORMATIONAL SUBMITTALS

A. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

- B. Verification Samples: For each finish product specified, two sets of samples, minimum size 6 inches (152 mm) square, representing actual product, color, and patterns and exhibiting the extremes range of color and other visual characteristics to be expected for the project.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

# 1.7 CLOSEOUT SUBMITTALS

- A. Provide manufacturer's maintenance instructions that include recommendations for cleaning and maintenance of cladding.
- B. Warranty Documentation.

# 1.8 QUALITY ASSURANCE

- A. Manufacturer/Fabricator Qualifications: Minimum of 5 years experience in the manufacturing of the panel product specified and meeting the following:
  - 1. Manufacturing facilities utilized in production ISO-9001 certified.
  - 2. Panels shall be tested in a dedicated and certified on-site lab using approved ASTM testing standards and conducted for every 10,000 SF of panels.
- B. Installer Qualifications: Minimum 3 years documented experience in work of this Section and the type of panel products specified.
- C. Mock-Up: Provide a 4 foot high by 8 foot wide mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until color and workmanship is approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

# 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery and installation of stone panel cladding with all parties involved to avoid extended on-site storage and coordinate with work adjacent to stone panel cladding. Ship panels by elevation in a pre-determined priority sequence to be determined prior to production.
- B. Store products in manufacturer's properly labeled, unopened packaging until ready for installation.
- C. Store panels off ground; prevent contact with materials that could cause staining or damage.
- D. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminates, corrosion, breaking, chipping, and other causes.

- E. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.
- F. Lay out and arrange panels on the ground in the order of the elevation sequence for inspection of color consistency and panel alignment.
- G. Perform detailed quality control check on every panel prior to packaging.
- H. Package all panels in custom plywood crates using protective covers on all of the panel edges and fill the gaps between panels with expandable foam for maximum protection.

# 1.10 PROJECT CONDITIONS

- A. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before stone wall panel fabrication, as the project schedule permits.
- 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 absolute limits.
  - 1. Cold-Weather Requirements: Comply with cold-weather construction and protections requirements for masonry contained in ACI 530.1/ASCE6/TMS 602. Remove and replace honeycomb-backed stone panels damaged by frost or freeing conditions.
  - 2. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in ACI 530.1/ASCE 6/TMS 602.

# 1.11 WARRANTY

A. Provide manufacturer's limited 10 year limited warranty against delamination and separation of panel components

# PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Design Requirements : Design exterior stone cladding system to withstand:
  - 1. Positive and negative design wind loads acting normal to wall plane in accordance with Building Code and ASCE 7 with deflection of any member not to exceed L/175, as tested to ASTM E 330.
  - 2. Movement caused by an ambient temperature range of 120 degrees F and a surface temperature range of 160 degrees F.
- B. Performance Requirements:

- 1. Air Infiltration: Maximum 0.01 CFM per square foot, tested to ASTM E 283 at pressure differential across assembly of 6.24 PSF.
- 2. Water Resistance: No leakage, tested to ASTM E 331 at 12.0 PSF.
- 3. Uniform Load Deflection:
  - a. Two Panel Specimen: No damage, tested to ASTM E 330 at 65 PSF positive and negative.
  - b. Single Panel Specimen: No damage, tested to ASTM E 330 at 260 PSF positive and negative.
- 4. Uniform Load Structural:
  - a. Two Panel Specimen: No damage and maximum 0.07 inch permanent set, tested to ASTM E 330 at 97.5 PSF positive and negative.
  - b. Single Panel Specimen: No damage and maximum 0.150 inch permanent set, tested to ASTM E 330 at 390 PSF positive and negative.
- 5. Impact Resistance: No penetration, tested to ASTM E 1996 at 50 FPS.
- 6. Freeze/Thaw Resistance: No delamination, cracking, chipping, or visible distortion; tested to GB/T 9966.1 at 25 cycles.
- 7. Adhesive Bond: Average bond strength of 284 PSI, tested to ASTM D 897.
- 8. Tensile Bond Strength for Adhesive: Average of 358 PSI, tested to ASTM D 897 after 25 thermocycles.
- 9. Shear Load Strength for Riveted Brackets: Average of 172 PSI, tested to ASTM D 1761.
- 10. Fire Hazard Classification: Maximum flame spread/smoke developed rating of 10/155, tested to ASTM E 84.

# 2.2 MANUFACTURERS

- 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. StonePly Co., www.stoneply.com.
  - 2. TerraCORE Panels, LLC, www.terracorepanels.com.
  - 3. Basis of Design Panel: TerraCORE Stone Panels manufactured by TerraCORE Panels, LLC.

# 2.3 EXTERIOR STONE CLADDING

- A. Panels: Aluminum "T" honeycomb substrate with a Fire Retardant Filler bonded to a natural thin stone veneer.
- B. Panel Size: Provide maximum lengths and widths available to work with panel sizes as indicated on the Drawings.
- C. Weight including stone facing:
  - 1. 4 to 5 lbs/sf (19.53 to 24.41 kg / sq.M).
- D. Reinforcing: 3/4 inch (19 mm) honeycomb backing bonded to stone by high strength adhesive impregnated by reinforced fiberglass sheet.
  - 1. Fiberglass Top Sheet: 1 mm.

- 2. Honeycomb Core: 17 mm
- 3. Aluminum backing sheet: 1 mm.
- 4. Overall panel thickness: 1 inch (25.4 mm).
- E. Stone Facing Type/Color: 1/14 inch (6 mm) plus or minus 1/16 inch (1.6 mm) natural stone.
  - 1. Granite, facing type and color as selected by Architect from manufacturer's full range of available products to blend with existing facade materials.
- F. Surface Finish: As selected by Architect from manufacturer's full range of available products to blend with existing facade materials.
- G. Panel Edges: Apply FRF (Fire Retardant Fill) to all edges of the aluminum honeycomb (exposed or not) to fill voids in honeycomb. Edges to be smooth and filled. Use FRF with color similar to stone.
- H. Corners and Returns: Provide prefabricated panel units with mitered corners, bonded with epoxy and finished exposed surfaces.
  - 1. Hanging Channels: Continuous extruded aluminum rails.
  - 2. Channel Material: ASTM B 221, 6063-T5ORT6 alloy and temper.
  - 3. Finish: Flat black anodized finish where exposed.
  - 4. Water Weepage: Allow water to pass between channel and substrate.
  - 5. Connection and anchorage hardware, including interlocking channels, anchor plates, structural silicone and threaded inserts shall be of sufficient size, thickness and strength to properly support panels and applied loads. Panel fastening shall be completely concealed.
- I. Accessories:
  - 1. Fasteners: Concealed type except where unavoidable and suited to application, stainless or corrosion resistant coated steel.
  - 2. Joint Sealers: Type recommended by panel manufacturer as specified in Section 079200 "Joint Sealants."

#### 2.4 FABRICATION

- A. Fabricate manufacturer's standard interlocking channel system. System shall allow for the free and noiseless vertical and horizontal thermal movement due to expansion and contraction. Buckling of panels, opening of joints, undue stress on fasteners, failure of sealants or any other detrimental effects due to thermal movement will not be permitted
- B. Attach channels to back of panels in factory.
- C. Where indicated shop fabricate panel returns in factory with hairline joints to appear as monolithic stone.

# 3.1 EXAMINATION

- A. Examine surfaces to receive stone panels and conditions under which they will be installed for compliance with installation tolerances and other conditions affecting performance of panels.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Before setting panels, clean surfaces that are dirty or stained by removing soil, stains and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Install interlocking channel system properly aligned for the panel installation.
- C. Set panels aligned, level, and plumb. Shim as required with hard plastic shims up to a maximum of 1/2 inch thick.
- D. Fasten receiving channels to supports. Snap panels into receiving channels. Use silicone sealant in bed of channel if recommended by the manufacturer.
- E. Seal panel joints with joint sealer as specified in Section 079200 "Joint Sealants."
- F. Allowable Tolerances:
  - 1. Variation from Plumb: For vertical lines, external comers and surfaces of walls, do not exceed 1/8 inch in 10 feet, 3/16 inch in 20 feet, or 1/4 inch in 40 feet or more.
  - 2. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/16 inch in 10 feet, 1/8 inch in 20 feet or 3/16 inc maximum.
  - 3. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed 1/8 inch in 20 feet or 1/4 inch in 40 feet or more.

- 4. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/8 inch.
- 5. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/16 inch or a quarter of nominal joint width, whichever is less. For joints within 60 inches of each other, do not vary more than 1/16 inch or a quarter of nominal joint width, whichever is less from one to the other.
- 6. Variation in plane between adjacent stone units (lipping): Do not exceed 1/16 inch difference between planes of adjacent units.
- G. Separate dissimilar metals and use gasket fasteners where needed to eliminate the possibility of corrosive or electrolytic action between metals.

# 3.4 ADJUSTING AND CLEANING

- A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and honeycomb-backed stone panel cladding that does not match approved samples.
- B. Repair panels with minor damage as acceptable to the Architect.
- C. Clean stone panel cladding as work progresses. Remove excess sealant and smears as sealant is installed.
- D. Clean stone panel cladding no fewer than six days after completion of pointing and sealing. Clean using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

#### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials from stone without damage to the stonework.
- C. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
- D. Touch-up, repair or replace damaged products before Substantial Completion.

# END OF SECTION 044220

# SECTION 051200 - STRUCTURAL STEEL FRAMING

# 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. Structural steel.
  - 2. Shrinkage-resistant grout.
- B. Related Requirements:
  - 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
  - 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
  - 3. Section 099100 "Painting" for painting requirements.

### 1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

#### 1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of 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.

# 1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

# 1.6 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  - 5. Identify members and connections of the seismic-load-resisting system.
  - 6. Indicate locations and dimensions of protected zones.
  - 7. Identify demand-critical welds.
  - 8. Identify members not to be shop primed.
- B. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.7 INFORMATIONAL SUBMITTALS

- A. Mill test reports for structural-steel materials, including chemical and physical properties.
- B. Product Test Reports: For the following:
  - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
  - 2. Direct-tension indicators.
  - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 4. Shear stud connectors.
- C. Survey of existing conditions.
- D. Field quality-control reports.

#### 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P2 or to SSPC-QP 3.

- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

# 1.9 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 corrosion and deterioration.
  - 1. 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.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

# PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303.
  - 2. ANSI/AISC 341.
  - 3. ANSI/AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
  - 1. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
    - a. Use Allowable Stress Design; data are given at service-load level.
- C. Moment Connections: Type FR, fully restrained.

- D. Construction: Combined system of moment frame, braced frame, and shear walls.
- 2.2 STRUCTURAL-STEEL MATERIALS
  - A. W-Shapes: ASTM A992/A992M.
  - B. Channels, Angles, M, S-Shapes: ASTM A36/A36M.
  - C. Plate and Bar: ASTM A36/A36M.
  - D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.
  - E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
    - 1. Finish: Black except where indicated to be galvanized.
  - F. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.
  - G. Steel Forgings: ASTM A668/A668M.
  - H. Welding Electrodes: Comply with AWS requirements.

# 2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip or mechanically deposited zinc coating.
  - 2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex or round head assemblies, consisting of steel structural bolts

with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

- 1. Finish: Plain.
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

# 2.4 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A563 heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A36/A36M carbon steel.
  - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
  - 5. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
- B. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
  - 1. Nuts: ASTM A563 heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A36/A36M carbon steel.
  - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
  - 4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.
- C. Threaded Rods: ASTM A36/A36M.
  - 1. Nuts: ASTM A 63 heavy-hex carbon steel.
  - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
  - 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C or Mechanically deposited zinc coating, ASTM B695, Class 50.

#### 2.5 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

# 2.6 SLIDE BEARINGS

- A. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
  - 1. Mating Surfaces: PTFE and PTFE.
  - 2. Coefficient of Friction: Not more than 0.03.
  - 3. Design Load: Not less than 5,000 psi.
  - 4. Total Movement Capability: 2 inches.

# 2.7 PRIMER

- A. Steel Primer:
  - 1. Comply with Section 099100 "Painting"
  - 2. SSPC-Paint 23, latex primer.
  - 3. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: MPI#80,.
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: ASTM A780/A780M.

# 2.8 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

# 2.9 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shoppriming operations.

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.
- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wallopening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- G. Welded-Steel Door Frames: Build up welded-steel door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

#### 2.10 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### 2.11 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

- 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
- 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

# 2.12 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces unless indicated to be painted.
  - 6. Corrosion-resisting (weathering) steel surfaces.
  - 7. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
  - 1. SSPC-SP 6 (WAB)/NACE WAB-3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

# 2.13 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- a. Liquid Penetrant Inspection: ASTM E165/E165M.
- b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- c. Ultrasonic Inspection: ASTM E164.
- d. Radiographic Inspection: ASTM E94/E94M.
- 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear stud connector.
  - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
- 5. Prepare test and inspection reports.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
  - 1. Do not remove temporary shoring supporting composite deck construction and structuralsteel framing until cast-in-place concrete has attained its design compressive strength.

# 3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

# 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### 3.5 PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with ANSI/AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

### 3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

#### 3.7 **PROTECTION**

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099100 "Painting"

#### END OF SECTION 051200

SECTION 053100 - STEEL DECKING

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. Roof deck.

### 1.3 ACTION SUBMITTALS

- A. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

#### 1.4 QUALITY ASSURANCE

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

### PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

### 2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 or Grade 40, G90 zinc coating.
  - 2. Deck Profile: Type B.
  - 3. Profile Depth: 1-1/2 inches.
  - 4. Design Uncoated-Steel Thickness: 20 gage.
  - 5. Span Condition: Triple span or more.
  - 6. Side Laps: Overlapped.

### 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

- K. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

# 3.3 ROOF-DECK INSTALLATION

A. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated

- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- C. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space fasteners not more than 12 inches apart with at least one fastener at each corner.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

#### 3.5 **PROTECTION**

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 053100

# SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

### 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. Rooftop equipment bases and support curbs.
  - 2. Wood blocking , cants, and nailers.
- B. Related Requirements:
  - 1. Section 061600 "Sheathing" for sheathing.

#### 1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Preservative-treated wood.
  - 2. Power-driven fasteners.

- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

# PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

### 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.

- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

# 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

# 2.5 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

# PART 3 - EXECUTION

# 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. [Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.]

- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.

# 3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

#### END OF SECTION 061053

### SECTION 061600 - SHEATHING

# 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. Wall sheathing.
  - 2. Sheathing joint and penetration treatment.
- B. Related Requirements:
  - 1. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

# 1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

# 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

# PART 2 - PRODUCTS

#### 2.1 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corporation; GlasRoc
    - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
    - c. National Gypsum Company; Gold Bond® eXP® Sheathing.
    - d. USG Corporation; Securock.
  - 2. Type and Thickness: Type X, 5/8 inch thick.

3. Size: 48 by 96 inches .

### 2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M .
- B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
  - 1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

# 3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

- 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
- 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
- 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

#### END OF SECTION 061600

# SECTION 072119 - FOAMED-IN-PLACE INSULATION

# PART 1 - GENERAL

# 1.1 SUMMARY

- A. Section Includes:
  - 1. Closed-cell spray polyurethane foam insulation.
  - 2. Accessories.

# 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
  - 1. Product Test Reports: For each product, for tests performed by qualified testing agency.
- B. Field Quality-Control Submittals:
  - 1. Field quality-control reports.
- C. Qualification Statements: For Installer.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

# PART 2 - PRODUCTS

### 2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 7 deg F x h x sq. ft./Btu at 75 deg F.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Johns Manville; a Berkshire Hathaway company; Corbond IV or comparable product by one of the following:
    - a. Carlisle Spray Foam Insulation.
    - b. Henry Company.
- c. Huntsman Building Solutions.
- d. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.
- 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.

### 2.2 ACCESSORIES

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
  - 1. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.
  - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.

## PART 3 - EXECUTION

# 3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

## 3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

- F. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
  - 1. Apply thermal barrier coating over insulation at locations where another thermal barrier is not provided to encapsulate the insulation.
  - 2. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
  - 3. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

# 3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect spray foam insulation installation, including accessories. Report results in writing.

# 3.4 **PROTECTION**

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

# END OF SECTION 072119

### SECTION 072500 - WEATHER BARRIERS

## 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. Drainable building wrap.
  - 2. Flexible flashing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

## PART 2 - PRODUCTS

## 2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E84; UV stabilized; and acceptable to authorities having jurisdiction.
  - 1. <u>Manufacturers:</u> 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. Benjamin Obdyke Incorporated.
    - b. DuPont de Nemours, Inc.
    - c. Typar Geosynthetics; a PGI brand.
  - 2. Water-Vapor Permeance: Not less than 12 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
  - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E2178.

- 4. Water Penetration Resistance: 55 cm for 5 hours when tested in accordance with AATCC Test Method 127.
- 5. Moisture Drainage: 96% drainage efficiency.
- 6. Tensile Strength: Minimum 68.3 lbf MD, 60.1 lbf CD, when tested in accordance with ASTM D5034-95.
- 7. Allowable UV Exposure Time: Not less than three months.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## 2.2 FLEXIBLE FLASHING

- A. Flexible Flashing: Building wrap manufacturer's standard flexible flashing or product approved by building wrap manufacturer compatible with building wrap and substrate..
- B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.
- C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

# PART 3 - EXECUTION

## 3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
  - 1. Seal seams, edges, fasteners, and penetrations with tape.
  - 2. Extend into jambs of openings and seal corners with tape.

# 3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
  - 1. Prime substrates as recommended by flashing manufacturer.
  - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
  - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
  - 4. Lap water-resistive barrier over flashing at heads of openings.
  - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

## END OF SECTION 072500

## SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
  - 2. Accessory roofing materials.
  - 3. Vapor retarder.
  - 4. Cover board.

#### B. Related Requirements:

- 1. Section 061000 "Rough Carpentry for wood nailers, curbs, and blocking.
- 2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof copings.
- 3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

#### 1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site .
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Examine deck substrate conditions and finishes, including flatness and fastening.
  - 5. Review structural loading limitations of roof deck during and after roofing.
  - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
  - 7. Review governing regulations and requirements for insurance and certificates if applicable.
  - 8. Review temporary protection requirements for roofing system during and after installation.
  - 9. Review roof observation and repair procedures after roofing installation.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
  - 1. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
  - 2. Tie-in with air barrier.
- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
  - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field quality-control reports.
- F. Sample Warranties: For manufacturer's special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturers: A qualified manufacturer that is listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.

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2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

# 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

#### 1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Special warranty includes roof membrane, base flashings, fasteners, cover boards, and other components of roofing system.
  - 2. Warranty Period: 20 years from Date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.
  - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

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- 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
  - 1. As required by codes in effect at project location.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
  - 1. Wind Uplift Load Capacity: 90 psf.
- E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class B ; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

# 2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet.
  - 1. <u>Manufacturers:</u> 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. Carlisle SynTec Incorporated; Carlisle Construction Materials.
    - b. Firestone Building Products.
    - c. GenFlex Roofing Systems.
    - d. Versico Roofing Systems; Carlisle Construction Materials.
  - 2. Thickness: 60 mils , nominal.
  - 3. Exposed Face Color: Black .
  - 4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

## 2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
  - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

- C. Bonding Adhesive: Manufacturer's standard.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film .
- E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- H. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

#### 2.4 VAPOR RETARDER

- A. Polyethylene Film: ASTM D4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm .
  - 1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
  - 2. Adhesive: Manufacturer's standard lap adhesive, listed by FM Approvals for vapor retarder application.

# 2.5 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosionresistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Securock Gypsum Fiber Roof Board or comparable product by one of the following:
  - a. Certainteed; SAINT-GOBAIN.
  - b. Georgia-Pacific Gypsum LLC.
  - c. Gold Bond Building Products, LLC provided by National Gypsum Company.
- 2. Thickness: 1/2 inch .
- 3. ASTM E84 Surface-Burning Characteristics:
  - a. Flame Spread: 5.
  - b. Smoke Developed: 0.
- 4. Compressive Strength: 1800 psi.
- 5. Long Edges: Square.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
  - 1. Submit test result within 24 hours of performing tests.
    - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

- 3.3 INSTALLATION OF ROOFING, GENERAL
  - A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
  - B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
  - C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 061600 "Sheathing."

#### 3.4 INSTALLATION OF VAPOR RETARDER

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.
  - 1. Continuously seal side and end laps with tape .
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

## 3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
  - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 2. Cut and fit cover board tight to nailers, projections, and penetrations.
  - 3. Adhere cover board to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

## 3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.

- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
  - 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- J. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
  - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
  - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- K. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

## 3.7 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

#### 3.8 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

#### 3.9 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 075323

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Formed low-slope roof sheet metal fabrications.
  - 2. Formed equipment support flashing.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.

#### 1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
  - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
  - 3. Review requirements for insurance and certificates if applicable.
  - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following
  - 1. Underlayment materials.
  - 2. Elastomeric sealant.
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- 3. Epoxy seam sealer.
- B. Shop Drawings: For sheet metal flashing and trim.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
  - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
  - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
  - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 6. Include details of termination points and assemblies.
  - 7. Include details of roof-penetration flashing.
  - 8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
  - 9. Include details of special conditions.
  - 10. Include details of connections to adjoining work.
  - 11. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches .
- C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested .
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

- 1.8 QUALITY ASSURANCE
  - A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
    - 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested , shop shall be listed as able to fabricate required details as tested and approved.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
  - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
  - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

#### 1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No.8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing"

and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure: As indicated on Drawings .
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
  - 1. <u>Recycled Content:</u> Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
  - 2. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
  - 3. Color: As selected by Architect from manufacturer's full range .
  - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
  - 1. <u>Recycled Content:</u> Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
  - 2. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) ASTM A480/A480M, No. 3 (coarse, polished directional satin).
    - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- D. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.

- 1. <u>Recycled Content:</u> Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- 2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.
- 3. Exposed Coil-Coated Finish:
  - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [ for seacoast and severe environments].
  - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [ for seacoast and severe environments].
  - c. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [ for seacoast and severe environments].
  - d. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [ for seacoast and severe environments].
  - e. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
  - f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
- 4. Color: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color>.
- 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
  - 1. Source Limitations: Obtain underlayment from single source from single manufacturer.

- 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

# 2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

## 2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
  - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

- 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
- 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
- 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
  - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
  - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams:
  - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

## 2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight.

- 1. Coping Profile: As indicated on Drawings.
- 2. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate .
- 3. Fabricate from the following materials:
  - a. Aluminum: 0.050 inch thick.
- B. Roof-Penetration Flashing: Fabricate from the following materials:
  - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

## 2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:
  - 1. Stainless Steel: 0.0156 inch thick.

## 2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
  - 1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment:
  - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
  - 2. Prime substrate if recommended by underlayment manufacturer.

- 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
- 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
- 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
- 6. Roll laps and edges with roller.
- 7. Cover underlayment within 14 days.
- B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
  - 1. Install in shingle fashion to shed water.
  - 2. Lapp joints not less than 4 inches.

### 3.3 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
  - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
  - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
  - 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
  - 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
  - 8. Do not field cut sheet metal flashing and trim by torch.
  - 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressuretreated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
  - 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

- 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance .
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  - 1. Use sealant-filled joints unless otherwise indicated.
    - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    - b. Form joints to completely conceal sealant.
    - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    - d. Adjust setting proportionately for installation at higher ambient temperatures.
      1) Do not install sealant-type joints at temperatures below 40 deg F.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

## 3.4 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
  - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
  - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Copings:
  - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
  - 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
    - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch 16-inch centers.
    - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
  - 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

- 3.5 INSTALLATION OF WALL FLASHINGS
  - A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

## 3.6 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
  - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
  - 2. Weld or seal flashing with elastomeric sealant to equipment support member.

#### 3.7 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

#### 3.8 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

#### 3.9 **PROTECTION**

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

#### END OF SECTION 076200

# SECTION 079200 - JOINT SEALANTS

# 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. Nonstaining silicone joint sealants.
  - 2. Urethane joint sealants.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Sustainable Design Submittals:
  - 1. <u>Product Data:</u> For sealants, indicating VOC content.
  - 2. <u>Laboratory Test Reports:</u> For sealants, indicating compliance with requirements for lowemitting materials.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency .
- C. Field-Adhesion-Test Reports: For each sealant application tested.

D. Sample Warranties: For special warranties.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

### 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each kind of sealant and joint substrate.
  - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
  - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
  - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

### 1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet.

- 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
- 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

#### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. <u>VOC Content:</u> Verify sealants and sealant primers comply with the following:
  - 1. <u>Verify sealant complies with the</u> testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
  - 2. <u>Architectural sealants have a VOC</u> content of 250 g/L or less.
  - 3. <u>Sealants and sealant primers for porous substrates have a VOC content of 775 g/L or less.</u>
  - 4. <u>Sealants and sealant primers for nonporous substrates have a VOC content of 250 g/L or less.</u>

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf NB.
    - b. Pecora Corporation; Pecora 864NST.
    - c. Sika Corporation; Joint Sealants; Sikasil WS-295.
    - d. The Dow Chemical Company; Dow Corning® 795 Silicone Building Sealant.
    - e. Tremco Incorporated; Spectrem 2 or Spectrem 3.

#### 2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
    - a. LymTal International Inc; Iso-Flex 888QC.

#### 2.4 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

### 2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Remove laitance and form-release agents from concrete.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

## 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
  - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.

## 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

- 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
  - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
- 3. Inspect tested joints and report on the following:
  - a. Whether sealants filled joint cavities and are free of voids.
  - b. Whether sealant dimensions and configurations comply with specified requirements.
  - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
- 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
- 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.6 **PROTECTION**

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

# 3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Sealant: Urethane, M, P, 50, T, NT.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

END OF SECTION 079200

## SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

## 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 interior expansion joint cover assemblies.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Shop Drawings: For each expansion joint cover assembly.
  - 1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
  - 2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.
- D. Samples for Initial Selection: For each type of exposed finish.
  - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.
- E. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.
- F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
  - 1. Manufacturer and model number for each expansion joint cover assembly.
  - 2. Expansion joint cover assembly location cross-referenced to Drawings.
  - 3. Nominal, minimum, and maximum joint width.
  - 4. Movement direction.
  - 5. Materials, colors, and finishes.

- 6. Product options.
- 7. Fire-resistance ratings.

# 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency .
- 1.5 QUALITY ASSURANCE

## PART 2 - PRODUCTS

## 2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, crossconnections, and other accessories as required to provide continuous expansion joint cover assemblies.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.
- B. Expansion Joint Design Criteria <**Insert drawing designation**>:
  - 1. Type of Movement: [Thermal] [Wind sway].
    - a. Nominal Joint Width: [As indicated on Drawings] <Insert width>.
    - b. Minimum Joint Width: [As indicated on Drawings] < Insert width>.
    - c. Maximum Joint Width: [As indicated on Drawings] < Insert width>.
  - 2. Type of Movement: Seismic.
    - a. Joint Movement: As indicated on Drawings.

## 2.3 WALL EXPANSION JOINT COVERS

## 2.4 EXTERIOR EXPANSION JOINT COVERS

- A. Exterior Elastomeric-Seal Joint Cover <**Insert drawing designation**>: Assembly consisting of elastomeric seal anchored to surface-mounted frames fixed to sides of joint gap.
  - 1. <a></a>
    <a>
  - 2. Application: Wall to wall .
  - 3. Installation: Surface-mounted .
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- 4. Fire-Resistance Rating: Not less than that of adjacent construction .
- 5. Seal: Preformed elastomeric membrane or extrusion.
  - a. Color: As selected by Architect from manufacturer's full range .
- B. Preformed Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or fieldapplied adhesive for bonding to substrates.
  - 1. <a></a>
    <a>
  - 2. Design Criteria:
    - a. Nominal Joint Width: As indicated on Drawings .
    - b. Movement Capability: [-25 percent/+25 percent].
  - 3. Joint Seal Color: As selected by Architect from full range of industry colors .

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

#### 3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
  - 1. Provide in continuous lengths for straight sections.
  - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
  - 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

- C. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
  - 1. Install each length of seal immediately after removing protective wrapping.
  - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
  - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
  - 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

#### 3.4 **PROTECTION**

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 079513
## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### 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 standard steel doors and frames.
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

#### 1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

#### 1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
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- 4. Locations of reinforcement and preparations for hardware.
- 5. Details of each different wall opening condition.
- 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
- 7. Details of anchorages, joints, field splices, and connections.
- 8. Details of accessories.
- 9. Details of moldings, removable stops, and glazing.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

### 1.6 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

### 1.7 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

#### 1.8 QUALITY ASSURANCE

- A. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames."
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of firerated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- C. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. Ceco Door; ASSA ABLOY.
  - 2. Curries Company; ASSA ABLOY.
  - 3. Republic Doors and Frames.
  - 4. Steelcraft; an Allegion brand.

### 2.2 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.10 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

#### 2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. .
  - 1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
    - d. Edge Construction: Model 1, Full Flush .
    - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
    - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
    - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
    - h. Core: Manufacturer's standard Polyurethane .
  - 2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
- b. Construction: Full profile welded.
  - 1) Frame capable of receiving electronic lock.
- 3. Exposed Finish: Prime .

### 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

## 2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Polyurethane Insulation: Manufacturer's standard for insulated steel doors.

H. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.6 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

#### 2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  - 2. Fire-Rated Openings: Install frames according to NFPA 80.
  - 3. Floor Anchors: Secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 4. Solidly pack mineral-fiber insulation inside frames.
  - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.
  - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollowmetal manufacturer's written instructions.

## 3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- C. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

## 3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

## SECTION 083113 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Access doors and frames.
  - 2. Fire-rated access doors and frames.
  - 3. Security Access Doors and Frames
- B. Related Requirements:
  - 1. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

#### 1.2 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- C. Product Schedule: For access doors and frames.

### 1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

## 2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges <**Insert drawing designation**>:
  - 1. <u>Manufacturers:</u> 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. Activar Construction Products Group, Inc. JL Industries.
    - b. ACUDOR Products, Inc.
    - c. Karp Associates, Inc.
    - d. Williams Bros. Corporation of America (The).
      - 1) Basis of Design: WB ADWT Series.
  - 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
  - 3. Locations: Ceiling .
  - 4. Door Size: 36 x 36 inch, unless noted otherwise .
  - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch , 16 gage <**Insert thickness**>, factory primed .
  - 6. Frame Material: Same material, thickness, and finish as door .
  - 7. Latch and Lock: Cam latch, screwdriver operated Stainless Steel allen head screws.
- B. Flush Access Doors with Concealed Flanges < Insert drawing designation >:
  - 1. <u>Manufacturers:</u> 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. Activar Construction Products Group, Inc. JL Industries.
    - b. ACUDOR Products, Inc.
    - c. Karp Associates, Inc.
    - d. Williams Bros. Corporation of America (The).
  - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
  - 3. Locations: Ceiling Wall and ceiling .
  - 4. Door Size: 36 x 36 inch, unless noted otherwise .
  - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch , 16 gage factory primed .
  - 6. Frame Material: Same material and thickness as door .
  - 7. Latch and Lock: Cam latch, screwdriver operated .

# 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

# A. Fire-Rated, Flush Access Doors with Concealed Flanges < Insert drawing designation >:

- 1. <u>Manufacturers:</u> 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. Activar Construction Products Group, Inc. JL Industries.
  - b. ACUDOR Products, Inc.
  - c. Karp Associates, Inc.
  - d. Williams Bros. Corporation of America (The).
- 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal ; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
- 3. Locations: Ceiling Wall and ceiling .
- 4. Door Size: 36 x 36 inch, unless noted otherwise .
- 5. Fire-Resistance Rating: Not less than that of adjacent construction .
- 6. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
- 7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch , 20 gage <**Insert thickness**>, factory primed .
- 8. Frame Material: Same material, thickness, and finish as door .
- 9. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob.

## 2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

## 2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

## 2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for 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. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces unless noted otherwise.

## 3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
  - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

## 3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

## 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. Suspension systems for interior ceilings and soffits.
- B. Related Requirements:
  - 1. Section 092900 "Gypsum Board."

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 SUSPENSION SYSTEMS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- C. Hanger Attachments to Concrete:
  - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or AC308 as appropriate for the substrate.
    - a. Uses: Securing hangers to structure.
    - b. Type: Torque-controlled, expansion anchor .
    - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

- D. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- E. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated .
- F. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
  - 1. Depth: 1-1/2 inches.
- G. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inchwide flanges, 3/4 inch deep.

## 2.2 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

A.Installation Standard: ASTM C754.21254-02NON-STRUCTURAL METAL FRAMING

- 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

## 3.4 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Hangers: 48 inches o.c.
  - 2. Carrying Channels (Main Runners): 48 inches o.c.
  - 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards .
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

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- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support .
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

SECTION 092900 - GYPSUM BOARD

### 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 gypsum board.
- B. Related Requirements:
  - 1. Section 092216 "Non-Structural Metal Framing" for suspension systems that support gypsum board panels.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

#### 1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### 2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products below that may be incorporated into the Work include, but are not limited to, the following:
  - 1. CertainTeed Gypsum.
  - 2. Georgia-Pacific Gypsum LLC.
  - 3. National Gypsum Company.
  - 4. USG Corporation.

## 2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Ceiling Board: ASTM C1396/C1396M.
  - 1. Thickness: 1/2 inch.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

## 2.4 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and substrates including support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports.
- E. Do not place tapered edges against cut edges or ends.

#### 3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Ceiling Type: Ceiling surfaces.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels at right angles to framing unless otherwise indicated.
  - 2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

#### 3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

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- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated .
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
    - b. This is typical finish unless otherwise noted in drawings.

### 3.5 **PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## SECTION 095123 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustical tiles.
  - 2. Metal suspension system.
  - 3. Accessories.
  - 4. Metal edge moldings and trim.
- B. Related Requirements:
  - 1. Section 095113 "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
  - 2. Section 095133 "Acoustical Metal Pan Ceilings" for ceilings consisting of metal-pan units with exposed and concealed suspension systems.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

## 1.2 ACTION SUBMITTALS

- A. Product Data:
  - 1. Acoustical tiles.
  - 2. Metal suspension system.
  - 3. Accessories.
  - 4. Metal edge moldings and trim.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.

- 1.3 INFORMATIONAL SUBMITTALS
- 1.4 CLOSEOUT SUBMITTALS
- 1.5 QUALITY ASSURANCE

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

#### 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
- 2.2 ACOUSTICAL TILES < Insert drawing designation>
  - A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - 1. Armstrong World Industries, Inc.
    - 2. CertainTeed; SAINT-GOBAIN.
  - B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
  - C. Color: Match Existing .

## 2.3 METAL SUSPENSION SYSTEM < Insert drawing designation>

A.Manufacturers:Subject to compliance with requirements, undefined:21254-02ACOUSTICAL TILE CEILINGS

- 1. Armstrong Ceiling & Wall Solutions.
- 2. CertainTeed; SAINT-GOBAIN.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.
  - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" in accordance with ASTM C635/C635M.
- C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.
  - 1. Structural Classification: Intermediate -duty system.
  - 2. Access: **[Upward] [Downward]** and **[end pivoted] [or] [side pivoted]**, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
    - a. Initial Access Opening: In each module, 24 by 24 inches Match Existing .

### 2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
  - 2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
  - 3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

### 2.5 METAL EDGE MOLDINGS AND TRIM < Insert drawing designation>

- A. <u><Click here to find, evaluate, and insert list of manufacturers and products.></u>
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic

design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

- 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- 2. Finish: Painted white .

### 2.6 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## 2.7 MISCELLANEOUS MATERIALS

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-inplace concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- C. Layout openings for penetrations centered on the penetrating items.

## 3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

- 1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 8. Do not attach hangers to steel deck tabs.
  - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
  - 1. As indicated on reflected ceiling plans.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
  - 1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
  - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
  - 3. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

#### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet , non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet , non-cumulative.

### 3.5 ADJUSTING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

### SECTION 099123 - INTERIOR PAINTING

## 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. Primers.
  - 2. Water-based finish coatings.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.

#### 1.4 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. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### 1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide Sherwin-Williams Company (The); products as indicated or comparable product by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. PPG Paints; PPG Industries, Inc.
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

## 2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. <u>VOC Content:</u> For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. <u>Primers, Sealers, and Undercoaters:</u> 100 g/L.
- C. <u>Low-Emitting Materials:</u> For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors: As indicated in drawings. .

#### 2.3 PRIMERS

- A. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.
  - 1. Basis of Design: Sherwin Williams, ProMar 200 Zero VOC Latex Primer.

### 2.4 WATER-BASED FINISH COATS

- A. Interior, Latex, Flat: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
  - 1. Basis of Design: Sherwin Williams, ProMar 200, Zero-VOC Interior Latex Flat.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

## 3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 4. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

## 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
  - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
  - 3. Allow empty paint cans to dry before disposal.
  - 4. Collect waste paint by type and deliver to recycling or collection facility.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.5 INTERIOR PAINTING SCHEDULE

- A. Gypsum Board Ceilings
  - 1. First Coat Primer: Sherwin Williams, ProMar200 Zero VOC Latex Primer.
  - 2. Second Coat: Sherwin Williams, ProMar200 Zero VOC Latex Flat.
  - 3. Finish Coat(s): Sherwin Williams, ProMar200 Zero VOC Latex Flat.

### SECTION 099600 - HIGH-PERFORMANCE COATINGS

## 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 surface preparation and the application of high-performance coating systems on the following substrates:
  - 1. Exterior Substrates:
    - a. Concrete masonry units (CMUs).
    - b. Steel.
    - c. Galvanized metal.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

## 1.5 QUALITY ASSURANCE

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### 1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. <u>Manufacturers:</u> 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. Benjamin Moore & Co.
  - 2. PPG Paints; PPG Industries, Inc.
  - 3. Sherwin-Williams Company (The).
  - 4. Tnemec Company, Inc.

### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  - 3. Products shall be of same manufacturer for each coat in a coating system.

## 2.3 SOURCE QUALITY CONTROL

A.Testing of Coating Materials: Owner reserves the right to invoke the following procedure:21254-02HIGH-PERFORMANCE COATINGS099600 - 2

- 1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
- 2. Testing agency will perform tests for compliance with product requirements.
- 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

- 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer [.] but not less than the following:
  - 1. SSPC-SP 7/NACE No. 4.
  - 2. SSPC-SP 11.
  - 3. SSPC-SP 6/NACE No. 3.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

## 3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  - 1. Use applicators and techniques suited for coating and substrate indicated.
  - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Coat front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

## 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
  - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

#### 3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

a.

- 1. Epoxy-Modified Latex System :
  - Prime Coat: Primer, rust inhibitive, water based.
    - 1) Basis of Design: Sherwin Williams Pro Industrial Pro-Cryl Primer .
  - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
  - c. Topcoat: Epoxy-modified latex, semi-gloss.
    - 1) Basis of Design: Sherwin Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss.
- B. Gypsum Board Substrates:
  - 1. Epoxy-Modified Latex System :
    - a. Prime Coat: Primer sealer, latex, interior.
      - 1) Basis of Design: Sherwin Williams ProMar 200 Zero VOC Primer .
    - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
    - c. Topcoat: Epoxy-modified latex, gloss level to match corresponding latex paint designations.
      - 1) Basis of Design: Sherwin Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel .
# SECTION 211000 - FIRE-SUPPRESSION SPRINKLER SYSTEM

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Furnish and install relocations, additions, and revisions to the existing wet pipe sprinkler system as required to facilitate the renovations. Revisions and alterations include but may not necessarily be limited to added sprinkler coverage below new duct mains in the mechanical room.
- B. This Section includes fire-suppression sprinklers, piping, and equipment.
- C. The Sprinkler Contractor shall place the sprinkler system in service and hand over the sprinkler system to the General Contractor for care and maintenance.
- D. Performance and Design Criteria: Provide products and systems complying with specific performance and design criteria indicated.

### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinklers and obtain approval from authorities having jurisdiction. The design of the automatic sprinkler system shall be complete with all necessary accessories for proper operation.
- B. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any authority having jurisdiction.
- C. Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction:
  - 1. Include a 5 percent margin of safety for available water flow and pressure.
  - 2. Include losses through water-service piping, valves, and backflow preventers.
- D. Sprinkler Occupancy Hazard Classifications:
  - 1. Light Hazard:
    - a. Office and Public Areas
    - b. Corridors

- 2. Ordinary Hazard, Group 1:
  - a. General Storage Areas
  - b. Mechanical Equipment Rooms
  - c. Building Service Areas.
  - d. Electrical Equipment Rooms
- E. Minimum Density for Automatic-Sprinkler Piping Design shall be in accordance with NFPA 13. Maximum Protection Area per Sprinkler shall be in accordance with NFPA 13.

### 1.4 GENERAL REQUIREMENTS

- A. Components and Installation: Capable of producing piping systems with 175-psig minimum working-pressure rating, unless otherwise indicated.
- B. Protect all systems from freezing. Provide freeze protection for sprinklers in unheated areas with a dry pipe system.
- C. Bundled/Grouped wired in concealed spaces: Non-combustible spaces having 15 or more nonplenum-rated wires grouped together shall be fully sprinklered.
- D. Seismic Performance: If required by the authority with jurisdiction, fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 7 for materials. Seal all penetrations through fire-or smoke-rated wall, partition, ceiling, or roof assemblies with firestopping system. Refer to Architectural plans for location of rated assemblies.
- F. Contractor shall obtain and pay for required permits.

### 1.5 SUBMITTALS

- A. Shop Drawings: Submit working plans, prepared according to NFPA 13, and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other authorities having jurisdiction.
- B. Product Data: Catalog sheets, specifications, and installation instructions. Indicate UL or FM approval for each product. Include the following additional information:
  - 1. Pipe and fitting materials and methods of joining for sprinkler piping.
  - 2. Pipe hangers and supports.
  - 3. Piping seismic restraints.
  - 4. Valves, including specialty valves, accessories, and devices.
  - 5. Alarm devices. Include electrical data.

- 6. Electrical Devices: Complete description of intended use, wiring diagrams, data plate information and, in the case of switching devices, whether normally on or normally off. Include motor test data.
- 7. Mechanical Devices: Complete description of intended use, including normal operating capacities and working pressures.
- 8. Enclosures: Dimensions, materials, gages of metals; type of door hinges and locks, and methods of securing the enclosure members to the building construction.
- 9. Hose Threads: Verify that hose threads on fire department connections match threads on equipment used by the local or servicing fire department.
- C. Design Data: The portions of the sprinkler system not sized on the Contract Drawings shall be sized in accordance with NFPA requirements for Hydraulically Designed Systems. Submit drawings and hydraulic calculations for approval.
- D. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible sprinkler system design professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Certification: Submit Contractor's NICET certification and number or PE license number.
- E. 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" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Maintenance Data: For each type of sprinkler specialty to include in maintenance manuals specified in Division 1.

# 1.6 QUALITY ASSURANCE

- A. Sprinkler Contractor
  - 1. Installer Qualifications: An experienced installer who has designed and installed firesuppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
  - 2. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified sprinkler designer. Sprinkler designer shall be legally qualified and licensed 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 fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.
  - 3. Contractor shall be a licensed fire sprinkler contractor.
- B. Manufacturer Qualifications:
  - 1. Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

- 2. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to authorities having jurisdiction.
- 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- 4. Factory Mutual Engineering Corporation (FM) Approval Guide
- C. NFPA Requirements: Year edition per authority of jurisdiction.
  - 1. NFPA #1: Fire Prevention Code
  - 2. NFPA #13: Standard for the Installation of Sprinkler Systems
  - 3. NFPA #14: Standard for the Installation of Standpipe, Private Hydrants and Hose Systems
  - 4. NFPA #20: If a fire pump is required, comply with NFPA 20: Stationary Pumps for Fire Protection.
  - 5. NFPA #24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
  - 6. NFPA #101: Life Safety Code
  - 7. NFPA #291: Recommend Practice for Flow Testing and Marking of Hydrants.

# 1.7 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8.
- C. Coordinate sprinkler head layout with all other trades.

# 1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Sprinkler Cabinets: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six spare sprinklers plus sprinkler wrench. Include the number of sprinklers required by NFPA 13 and wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

# PART 2 - PRODUCTS

- 2.1 PIPING
  - A. Pipe and fittings shall conform to the requirements of NFPA 13. Pipe shall be listed by UL and be FM approved, and installed per its listing and approval.

- B. Wet sprinkler piping shall be:
  - 1. Black steel Schedule 40 for 1 inch and smaller, and Schedule 10 for 1-½ inch and larger.
- C. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to the requirements set forth in N.F.P.A. 13. Materials used in the installation or construction of hangers and supports shall be listed and approved for such application.
- D. Provide joining materials in accordance with NFPA 13.
- E. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

# 2.2 SPRINKLERS

- A. Fire sprinklers shall be of one manufacturer throughout the building. No mixing of sprinkler brands shall be permitted. Sprinklers shall be of all brass frame construction with a quick response frangible bulb type fusible element.
- B. Automatic Sprinklers: With U.L. listed heat-responsive elements.
- C. Sprinkler Types and Categories: Provide per NFPA 13.
- D. Provide quick response sprinklers.
- E. Institutional Semi-Recessed or "Vandal-Resistant" sprinkler heads as required by application.
- F. Sprinkler Escutcheons: Materials, types, and finishes of sprinklers. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
- G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

# 2.3 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or lockinglug inlet and outlet, test valve, and orifice and sight glass.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

# FIRE-SUPPRESSION SPRINKLER SYSTEM

- F. Contractor Option: Provide flexible sprinkler hose with fittings intended for use in sprinkler systems between the branch line and sprinkler. Provide in accordance with NFPA 13 and the manufacturer's installation instructions. Length: 38".
  - 1. U.L. 2443 listed for sprinkler hose application.
  - 2. Flexible Hose: Corrugated Stainless Steel AISI 304
  - 3. Slip Nuts: Brass C3771BC
  - 4. Reducer Fitting: Yellow Zinc/Steel SPPS
  - 5. Special Shoulder Nipple (Inlet): Yellow Zinc/Steel SPPS
  - 6. Reducing Nipple Clamp & Bolt: Galvanized Steel SS41
  - 7. Maximum Working Pressure of Flexible Connection: 200 PSI
  - 8. Test Pressure of Flexible Connection: 400 PSI
  - 9. Maximum Temperature Rating of Flexible Connection: 300 °F
  - 10. Provide ceiling bracket.

# 2.4 VALVES

- A. Valves shall be UL listed and FMG approved
- B. An NFPA-13 compliant setup including a backflow device, system control valve, flow switch, inspectors test, drain, and pressure gauge may be provided in lieu of an alarm valve.
- C. System Control Valve: The wet system control valve shall be a listed indicating type valve. Control valve shall be UL Listed and Factory Mutual Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI.
- D. Manual or automatic air venting valve to exhaust trapped air in the wet sprinkler system.
- E. Automatic (Ball Drip) Drain Valves:
  - 1. Standard: UL 1726.
  - 2. Pressure Rating: 175-psig minimum.
  - 3. Type: Automatic draining, ball check.
  - 4. Size: NPS 3/4.
  - 5. End Connections: Threaded.

# PART 3 - EXECUTION

# 3.1 EXISTING SYSTEMS

- A. Refer to Division 1 demolition requirements and procedures. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
- B. Existing Sprinkler System Shutdown: Follow NFPA 13 and NFPA 25 recommendations. Before shutting down the sprinkler system to perform the Work, notify the Owner's Representative in writing, the local fire department, and the alarm company, that the system is to be shut down temporarily. Give schedule which states date and time of proposed shut down

and the approximate length of time that the system will be out of service. Request instructions for precautions that should be taken during the shutdown period. Do not shut down the system until schedule is approved by the Owner's Representative. Return the existing system to pre-shutdown operation immediately after the Work has been completed. Give written notice to the Director's Representative that the system has been returned to pre-shutdown operation.

# 3.2 PREPARATION

A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.

# 3.3 SPRINKLER APPLICATIONS

- A. General: Use sprinklers according to the following applications:
  - 1. Rooms/spaces without Ceilings: Upright sprinklers.
  - 2. All occupied rooms with Finished Ceilings: Recessed Pendent.
  - 3. Provide sprinkler guards for heads in mechanical and storage spaces, less than 8 ft. above finished floor subject to mechanical damage.

# B. Finishes

- a. Unfinished spaces not exposed to view: rough bronze.
- b. Recessed Sprinklers: White
- c. Provide escutcheons with matching color for finished spaces.

# 3.4 SYSTEM INSTALLATIONS

- A. Earthquake Protection: Provide piping according to NFPA 13 to protect from earthquake damage.
- B. A sprinkler head wrench of each style and model installed shall be provided to the owner at the completion of the project. A representative sampling of each sprinkler head style and model shall be provided to the owner and housed in a sprinkler head cabinet at or near the sprinkler riser. The number of sprinkler heads provided to the owner shall be in accordance with NFPA 13.
- C. Provide a vent near a high point in the system to allow air to be removed from that portion of the system.

# 3.5 SPRINKLER INSTALLATION

- A. Provide sprinklers in suspended ceilings in center of 2 X 2 ceiling tiles (not required for 2 X 4).
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use drytype sprinklers with water supply from heated space per NFPA 13.
- C. Provide sprinkler piping with drains for complete system drainage.
- D. Hangers and Supports: Comply with NFPA 13 for hanger materials.

# 3.6 LABELING AND IDENTIFICATION

A. Provide labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

# 3.7 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- G. Fill wet-pipe sprinkler piping with water.
- H. Energize circuits to electrical equipment and devices.
- I. Coordinate with fire alarm tests. Operate as required.

# 3.8 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

- C. Clean and disinfect fire-suppression water-service piping as follows:
  - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651.
  - 4. Prepare reports.

# 3.9 PAINTING

- A. Painting of fire-suppression systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

# 3.10 **PROTECTION**

A. Protect sprinklers from damage until Substantial Completion.

END OF SECTION 210000

SECTION 221123 – FACILITY FUEL GAS PIPING

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 22 Section: "Common Work Results"

### 1.2 SUMMARY

A. This Section includes fuel gas piping, specialties, and accessories.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Specialty valves
  - 2. Pressure regulators.
  - 3. Meters
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For fuel gas specialties and accessories to include in maintenance manuals specified in Division 1.
- D. Seismic Delegated-Design Submittal:
  - 1. For piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
    - a. Determine seismic restraint sizes and locations.
    - b. Provide seismic restraints as scheduled or specified.
    - c. Provide calculations and materials if required for restraint of un-isolated equipment.
    - d. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

- 2. Seismic restraints shall be designed in accordance with seismic force levels as detailed herein.
  - a. Applicable Code: IBC
  - b. Seismic Design Category: See structural plans.
  - c. Design Spectral Response at Short Periods (SDS): See structural plans.
  - d. Short Period Spectral Response Acceleration (SS): See structural plans.
  - e. Building Use Group or Occupancy Category: See structural plans.

# 1.4 QUALITY ASSURANCE

- A. All work shall be performed by fuel gas licensed technicians.
- B. Installations of fuel gas shall comply with the local fuel gas code: Maine Fuel Board Laws & Rules and NFPA 54.
- C. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Valves:
    - a. American Valve.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Crane Valves.
    - d. Grinnell Corp.
    - e. Honeywell, Inc.
    - f. McDonald: A. Y. McDonald Mfg. Co.
    - g. Milwaukee Valve Co., Inc.
    - h. Nibco, Inc.
    - i. Mueller Co.; Mueller Gas Products Div.
    - j. Watts Industries, Inc.
  - 2. Meters:
    - a. American Meter Co.
    - b. Badger Meter, Inc.; Utility Products Div.
    - c. Equimeter, Inc.

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- d. National Meter.
- e. Schlumberger Industries; Gas Div.
- 3. Pressure Regulators:
  - a. American Meter Co.
  - b. Equimeter, Inc.
  - c. Fisher Controls International, Inc.
  - d. Maxitrol Co.
  - e. National Meter.
  - f. Richards Industries, Inc.; Jordan Valve Div.
  - g. Schlumberger Industries; Gas Div.

# 2.2 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel.
- B. PE Pipe: ASTM D 2513, SDR 11.
  - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or flanged or suitable for welded connection.
    - e. Tracer wire connection.

- f. Ultraviolet shield.
- g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
- C. Transition Fittings: Type, material, and end connections to match piping being joined.
- D. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.
- E. Common Joining Materials: Refer to Division 23 Section "Common Work Results" for joining materials not in this Section.

# 2.3 SPECIALTY VALVES

- A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
- B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.
- C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.
- D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.
- E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating. Tamperproof Feature: Include design for locking.

# 2.4 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
  - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
  - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
  - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
  - 4. Corrugated stainless-steel tubing with polymer coating.
  - 5. Operating-Pressure Rating: 0.5 psig.
  - 6. End Fittings: Zinc-coated steel.
  - 7. Threaded Ends: Comply with ASME B1.20.1.
  - 8. Maximum Length: 72 inches
- B. Y-Pattern Strainers:
  - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.

- 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- 4. CWP Rating: 125 psig.
- C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.
- D. Pressure gages shall conform to ASME B40.100, Type I, Class 1. Pressure-gage size shall be 3-1/2-inch nominal diameter. Case shall be corrosion-resistant steel conforming to any of the AISI 300 series of ASTM A 666, with a No. 4 standard commercial polish or better. All gages shall be equipped with adjustable red marking pointer and damper screw adjustment in inlet connection.

# 2.5 PRESSURE REGULATORS

- A. Provide service, line, and appliance pressure regulators as indicated and as required by fuel code. Regulators may include vent limiting device, instead of vent connection to outside, if approved by authorities having jurisdiction. Provide venting as required by fuel code.
- B. Line Pressure Regulators: ANSI Z21.80 with 10-psig inlet pressure rating, unless otherwise indicated.
- C. Appliance Pressure Regulators: ANSI Z21.18.
- D. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

# 2.6 SEISMIC RESTRAINTS

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or 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 pre-approved 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. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
- C. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint.
- D. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required.

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E. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine roughing-in for gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section. Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Inspect gas piping according to fuel gas code to determine that gas utilization devices are turned off in piping section affected.
- D. Comply with fuel gas code requirements for prevention of accidental ignition.
- E. Make arrangements with local utility for gas service to the Owner's distribution system. Provide service to the building as required by the gas supplier. Coordinate all activities between the Owner and gas supplier. The installation of the gas service shall comply with the published gas supplier standards. Pay all utility company charges; include charges in the base bid.

# 3.3 PIPING APPLICATIONS

- A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
- B. Fuel Gas Piping: Use the following:
  - 1. NPS 2 and Smaller: steel pipe, malleable-iron threaded fittings, and threaded joints.
  - 2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

- 3. Gas Service Piping at Meters and Regulators: Steel pipe, steel welding fittings, and welded joints.
- 4. Underground Fuel Gas Piping, outdoors: Provide underground, PE, gas piping according to ASTM D 2774. Install underground piping buried at least 36 inches below finished grade.
- C. Provide containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.
- D. Concealed (gas piping that, when in place in a finished building, would require removal of permanent construction to gain access to the piping) Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
  - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
  - 2. In Floors: Not permitted.
  - 3. Concealed piping shall not be installed in solid partitions.
  - 4. Prohibited Locations: Do not install gas piping where not allowed by fuel gas code.
  - 5. In-slab (within building) Fuel Gas Piping: Not permitted.

# 3.4 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.
- B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.
- C. Piping Line Valves, NPS 2 and Smaller: Gas valve.
- D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

# 3.5 PIPING INSTALLATION

- A. Refer to Division 23 Section "Common Work Results" for installation of:
  - 1. Basic piping requirements.
  - 2. Joint construction requirements.
  - 3. Hanger, support, and anchor devices.
  - 4. Firestopping
  - 5. Sleeves and Escutcheons
  - 6. Wall penetration system at each service pipe penetration through foundation wall.
  - 7. Dielectric fittings
  - 8. Valves
  - 9. Mechanical Identification

- B. Drips and Sediment Traps: Provide drips at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Provide with space between bottom of drip and floor for removal of plug or cap.
- C. Provide fuel gas piping at uniform grade of <sup>1</sup>/<sub>4</sub>" per 15 feet.
- D. Use eccentric reducer fittings to make reductions in pipe sizes. Provide fittings with level side down.
- E. Connect branch piping from top or side of horizontal piping.
- F. Provide strainer on inlet of each line pressure regulator.
- G. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

# 3.6 SEISMIC RESTRAINT OF PIPING

- A. Seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
- B. Installation of seismic restraints must not cause any change of position of equipment or piping resulting in stresses or misalignment.
- C. Coordinate work with other trades to avoid rigid contact with the building.
- D. Overstressing of the building structure must not occur because of overhead support of equipment. Generally bracing may occur from flanges of structural beams, upper truss cords in bar joist construction, or cast in place inserts or wedge type drill-in concrete anchors.
- E. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, piping or conduit. Cable assemblies shall be installed taut on non-isolated systems. Seismic solid braces may be used in place of cables on rigidly attached systems only.
  - 1. The support rods must be braced when necessary to accept compressive loads with steel angles and rod clamp assemblies.
  - 2. At all locations where restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with pipe clevis cross bolt braces.
  - 3. Seismically restrain the following piping: Fuel gas piping that is 1" I.D. or larger.
  - 4. Piping exclusions:
    - a. Gas piping less than 1" inside diameter.
    - b. All piping suspended by individual hangers 12" or less as measured from the top of the pipe to the bottom of the support where the hanger is attached. However, if the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.

- c. The 12" exemption applies for trapeze-supported systems if the top of each item supported by the trapeze qualifies.
- 5. Transverse piping restraints shall be at 20' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- 6. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
- 7. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or tee or combined stresses are within allowable limits at longer distances.
- 8. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
- 9. Branch lines may not be used to restrain main lines.
- F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

# 3.7 CONNECTIONS

- A. Connect piping to appliances using appliance flexible connectors, shutoff valves, and unions. Provide valve upstream from and within 72 inches of each appliance. Provide union downstream from valve.
- B. Sediment Traps: Provide tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

# 3.8 PAINTING

- A. Paint exposed, exterior metal piping, valves, regulators, service meters and meter bars, and piping specialties, except components with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel
    - d. Color: As selected by Architect
- B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

# 3.9 FIELD QUALITY CONTROL

- A. Inspect, test, and purge piping according to fuel gas code and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.
- G. Verify that the gas piping has been grounded by Division 26 in accordance with NFPA requirements.
- H. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 221123

SECTION 230500 – COMMON WORK RESULTS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. This section applies to Plumbing Division 22 & and HVAC Division 23 sections.

### 1.2 GENERAL

- A. Section 230500 includes items common to all the division specification sections.
- B. Provide services, skilled and common labor, and all apparatus and materials required for the complete installation as shown and within the intent of the contract documents, field conditions, and code requirements.
- C. The intention of these Contract Documents is to call for finished work, fully tested and ready for operation. Any components or labor not mentioned in the Contract Documents but required for functioning systems shall be provided. Should there appear to be any discrepancies or questions of intent, the Contractor shall refer the matter to the Architect/Engineer for a decision before start of any related work.
- D. Consistency and Completeness: The contract documents are intended to include all components; however, the contract documents may not be perfect. Repetitive, common components (such as volume dampers, thermostats, condensate drains, trap primers, vent pipes, valves, etc.) are shown throughout. If a common component is missing in from the drawings, provide as similar per other areas. There will be no change orders for missing such components, the contractor shall provide consistent, complete, functioning systems.
- E. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract Documents.
- F. Materials or work described in words, which so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards. Since the plans and specifications cover the dimensions and features of the work and do not set forth the analysis of the design, it is the duty of the Contractor fulfilling them to ascertain the true intent in any case where it is doubtful.

### 1.3 MANUFACTURERS INSTRUCTIONS

- A. Provide equipment and components to comply with manufacturer's written installation instructions and published drawings.
- B. Follow manufacturer's instructions for inspection, start-up, calibration, commissioning, and testing.

# 1.4 DEFINITIONS

- A. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- B. "Provide": Furnish and install, complete and ready for the intended use.
- C. "Shall": The word "shall" is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and procedures and from which no deviation is permitted.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and attics.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. 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.
- I. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

### 1.5 SUBMITTALS

A. Provide in accordance with Division 1 of the specifications.

# 1.6 SUBSTITUTIONS

A. Provide in accordance with Division 1 of the specifications.

- B. Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work and shall be acceptable to all contractors involved.
  - 8. Equipment electrical characteristics different than scheduled may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost.
  - 9. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
  - 10. Requested substitution has been coordinated with other portions of the Work.
  - 11. Requested substitution provides specified warranty.

# 1.7 QUALITY ASSURANCE

- A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- B. 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.
- C. Installer Qualifications: Work shall be done by skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- D. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

# 1.8 COORDINATION

- A. Coordinate use of project space and sequence of installation of work, which is indicated diagrammatically on drawings. Follow routings shown, as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- B. Coordinate use of project space and sequence of installation of work.

- C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installations. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Coordinate requirements for access panels and doors for items requiring access that are concealed behind finished surfaces. Access panels shall be provided for any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced.
  - 1. Access panels and doors are specified and provided by Division 8.

# 1.9 TEST ADJUST AND BALANCE READINESS

- A. The Contractor shall provide and coordinate the services of qualified, responsible subcontractors, suppliers and personnel as required to correct, repair, and/or replace deficient items or conditions found during the course of this project, including the testing, adjusting, and balancing period.
- B. In order that systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor shall operate the systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner provided services, during the construction period, and prior to Substantial Completion as defined in the Uniform General Conditions of this Construction Document.
- C. The Drawings and Specifications indicate adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to provide these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB Firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor shall be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.
- D. Complete operational readiness of the HVAC systems also requires that the following be accomplished:
  - 1. Distribution Systems:
    - a. Verify installation for conformity to design. Ducts shall be terminated and tested as required by the Specification.
    - b. Dampers shall be properly located and functional. Dampers shall have tight closure and open fully with smooth and free operation.
    - c. RGD'S and terminal devices shall be provided and secured in a fully open position.
    - d. Air handling systems and associated apparatus shall be sealed to eliminate uncontrolled bypass or leakage of air. Clean filters shall be in place, coils shall be

clean with fins straightened, bearings properly greased, and the system shall be completely operational. The Contractor shall verify that systems are operating within the design pressure limits of the piping and ductwork.

- e. Under normal operating conditions, check condensate drains for proper connections and functioning. Cooling coil drain pans have a positive slope to drain. Cooling coil condensate drain trap maintains an air seal.
- f. Fans shall be operating and verified for freedom from vibration, proper fan rotation.
- g. Bearings shall be greased.
- h. Terminal units shall be provided and functional (i.e., controls functioning).
- 2. Water Circulating Systems:
  - a. Verify installation for conformity to design. Hydronic systems are pressure tested, flushed, filled, and properly vented; valves are fully open. Examine HVAC system and equipment installations to verify that indicated balancing devices are properly provided, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation
  - b. Valves shall be set to their fully open position. After the system is flushed and checked for proper operation, strainers shall be removed and cleaned. The Contractor shall repeat the operation until circulating water is clean and then the start-up strainers shall be discarded.
  - c. Record motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating. Thermal overload protection is in place.
  - d. In preparation of TAB, water circulating systems shall be full and free of air, expansion tanks shall be set for proper water level, and air vents shall be provided at high points of systems and operating freely. Chemicals shall be added to closed systems to treat piping and inhibit corrosion. The system static pressure shall be adequate to completely fill the system without operating the pumps.
  - e. Check and set operating parameters of the heat transfer and control devices to the design requirements.
  - f. Proper balancing devices shall be in place and located correctly. Heat transfer coils shall be checked for correct piping connections.
- 3. Building Automation System (BAS)
  - a. The BAS Contractor shall verify that control components are provided in accordance with project requirements and are functional.
  - b. The BAS Contractor shall verify that controlling instruments are calibrated and set for design operating conditions with the exception of components that require input from the TAB Agency, but a default shall be set. The Control Contractor shall cooperate with the TAB Agency and provide software and interfaces to communicate with the system.
  - c. The BAS Contractor shall thoroughly check controls, sensors, operators, sequences, etc. before notifying the TAB Agency that the BAS is operational. The BAS Contractor shall provide technical support (technicians and necessary computers) to the TAB Agency for a complete check of these systems.
  - d. Prior to occupancy, each ventilation system shall be tested to ensure that OA dampers operate properly in accordance with system design.

e. Fire Alarm: Division 26 shall thoroughly check detection devices, sequences, interlocks, etc. before notifying the TAB Agency that the system is operational. Division 26 shall certify that the systems are totally operational to the Contractor prior to the TAB beginning.

# 1.10 RENOVATION PROJECT REQUIREMENTS

- A. The Contractor shall cooperate with the Owner to minimize conflicts with the Owner's operations.
- B. The Contractor shall study drawings and specifications, visit the site, and get acquainted with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to be familiarized with the conditions and extent of the proposed work. The Contractor shall execute alterations, additions, removals, relocations, or new work, etc., as indicated, or required to provide a complete installation in accordance with the intent of the drawing and specifications.
- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Keep driveways and entrances serving premises clear and available to Owner. Schedule deliveries to minimize use of driveways and entrances and minimize space and time requirements for storage of materials and equipment on-site.
- D. Follow the recommended procedures of the SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- E. Continuity of Services: The building will be in use during construction operations. Maintain existing systems in operation within rooms of building. Schedules for various phases of contract work shall be coordinated with other trades and with Owner's Representative. Provide, as part of the contract, temporary plumbing and mechanical and electrical connections and relocations as required to accomplish the above. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services. Notify Owner at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions. Indicate method of providing temporary utilities. Do not proceed with utility interruptions without Owner's written permission.
- F. Cutting And Patching: Provide temporary support of Work to be cut. Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
  - 1. Where existing services/systems are required to be removed relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
  - 2. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- 3. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations.
- 4. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. Clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- 5. Any structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced so as to be left in safe structural condition in accordance with the local building code requirements.
- 6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- 7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

# PART 2 - PRODUCT

# 2.1 PRODUCT CRITERIA

- A. Any costs incurred due to deviations from basis of design unit shall be responsibility of the contractor.
- B. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 5 years.
- C. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
- D. 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.
- E. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- F. 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.
- G. Asbestos products or equipment or materials containing asbestos shall not be used.

# 2.2 PROGRAMMABLE 3-PHASE LINE VOLTAGE MONITORS

- A. Provide for all inverter-driven equipment.
- B. Provide an ICM Controls Model #ICM450A or equal, for motor protection from premature failure and damage caused by common voltage faults such as phase unbalance, over/under voltage, phase loss and phase reversal.
  - 1. Voltage: Universal, 190-600 VAC
  - 2. Simultaneous 3-phase true RMS voltage monitoring
  - 3. Factory calibrated.
  - 4. 3-phase voltages simultaneously displayed on LCD
  - 5. Fault memory
  - 6. Fault monitoring: High / low voltage, voltage unbalance, phase loss, phase reversal
  - 7. Simple configuration
  - 8. Fully adjustable variables
  - 9. Modbus RS485 communications
  - 10. LED indicators
  - 11. Common <sup>1</sup>/<sub>4</sub>" quick connect terminations.

### 2.3 IDENTIFICATION

- A. Equipment:
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
    - a. Lettering Size: Minimum letter height of 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
    - b. Stencil Material: Fiberboard or metal.
    - c. Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- B. In addition to the equipment tag, equipment located above the ceiling that requires servicing shall be labeled on the ceiling grid using a labeling machine.
- C. Piping Identification Devices
  - 1. Manufactured Pipe Markers, General: Seton, Brady, or approved equal; preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 2. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length. Size of letters and length of color field per ASME A13.1.
  - 3. Pipes with OD, Including Insulation; Full-band snap-around pipe markers extending 360 degrees around pipe at each location. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow. Length of color field and size of letters shall be proportional to pipe OD.

- 4. Types: Self-adhesive type: Seton Opti-Code; Snap-around type: Seton Setmark; Wraparound type: Seton Ultra-mark; PVF over-laminated polyester construction seals in and protects graphics; suitable for outdoor or harsh environments.
- D. Concealed manual volume dampers shall be visible outside the insulation and marked with 12" orange ribbon.
- E. Valve Tags & Schedules
  - 1. Valve Tags: Stamped or engraved 1-1/2 round with 1/4-inch letters for piping system legend and 1/2-inch black-filled numbers, with numbering scheme; 3/16" hole for fastener; Material: 19-gauge brass; Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.
  - 2. Valve Schedules: For each piping system, on standard-size bond paper. Also save in PDF format. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws. Frame: aluminum. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.
- F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing. Size: 3 by 5-1/4 inches minimum. Large-size primary caption such as "DANGER". Color: Yellow background with black lettering.

# 2.4 PIPE JOINING MATERIALS

- A. Provide per local code.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Press Connections
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress, Apollo, or approved equal.
  - 2. Press ends shall have Viega Smart Connect, Apollo Leak Before Press, or similar technology designed into the fitting itself, allowing identification of an un-pressed fitting during pressure testing. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

- 3. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by the fitting manufacturer.
- 4. Steel: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI/CSA LC4. Sealing elements for press fittings shall be HNBR. Sealing elements shall be factory installed or an alternative supplied by the fitting manufacturer. Piping and fittings shall comply with CSA LC-4 and local codes.
- E. Mechanical Coupling Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents and exterior environment. Gasket design shall be such that the entire coupling housing is isolated from the system contents to prevent galvanic action and inhibit galvanic corrosion.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- H. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- I. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Solvent Cements for Joining Plastic Piping: CPVC Piping: ASTM F 493. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- K. Plastic-to-Metal Transition Fittings: one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657. Plain-End Pipe and Fittings: Use butt fusion. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Provide dielectric isolation at the connection of dissimilar metals. Provide brass ball valves or fittings; or Watts Series LF3000 (lead free) or approved equal.

# 2.5 SLEEVES & ESCUTCHEONS

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Provide wall penetration system where service pipes penetrate through foundation wall or floor. Make installation watertight. Mechanical Sleeve Seals: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve; Thunderline Link-Seal, or approved equal.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Glass-reinforced nylon.
  - 3. Connecting Bolts and Nuts: Stainless steel, of length required to secure pressure plates to sealing elements.
- G. Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated. Metals and finish shall conform to ASME A112.19.2. Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. ID shall closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers the opening. Escutcheons shall have setscrews for maintaining a fixed position against a surface.

# 2.6 ROOF PIPING

- A. Roof Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosionresistant components to support roof-mounted piping. Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration. Bases: One or more; plastic. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- B. Roof Pipe Penetrations: Thybar TCC-3 curb system with cover and pipe boots.
  - 1. Prefabricated roof curb to be manufactured of prime galvanized steel construction, 20, 18, 16 or 14 gauge as required, meeting ASTM A653/653M, with welded corners and with seams joined by continuous welds. Roof curb shall be internally reinforced with angles 48" on center, factory insulated with 1-½" thick 3# density fiberglass insulation, and factory installed wood nailers. Height to be 18" above roof deck or as detailed. Top of all roof curbs shall be level, with pitch built into curb when deck slopes.
  - 2. ABS Thermoplastic cover on top of curb.
  - 3. Graduated Boots Molded or Weather-Resistant Plastisol
  - 4. SS pipe clamps, 2 per boot.

# 2.7 HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-Line Systems, Inc.
  - 2. Carpenter & Patterson, Inc.
  - 3. Grinnell Corp.
  - 4. Hubbard Enterprises/Holdrite
  - 5. National Pipe Hanger Corp.
  - 6. Piping Technology & Products, Inc.
  - 7. Unistrut
  - 8. Anvil International, Inc.
  - 9. Empire
- B. Provide in accordance with MSS SP69 Manufacturers Standardization Society: Pipe Hangers and Supports- Selection and Application. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped on the part itself for identification.
- C. The materials of pipe hanging and supporting elements shall be in accordance with MSS SP-58. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Do not allow dissimilar metals to come into contact.
- D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel." Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Comply with provisions in ASME B31 Series, "Code for Pressure Piping." Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Delegated-Design Submittal: For hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Show fabrication and installation details and include calculations. Provide for the following: trapeze pipe hangers, metal framing systems, pipe stands, equipment supports.
- F. Hangers:
  - Uninsulated pipes 2 inch and smaller: Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170; Adjustable steel swivel J-hanger, Type 5, B-Line B3690; Malleable iron ring hanger, Type 12, B-Line B3198R or hinged ring hanger, B3198H.Adjustable steel clevis hanger, Type 1, B-Line B3100.
  - 2. Uninsulated pipes 2-1/2 inch and larger: Adjustable steel clevis hanger, Type 1, B-Line B3100.
  - 3. Insulated Hot piping: 2 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield. 2-1/2 inch and larger pipes: Type 41 or Type 43 with Type 39A/39B, B3160-B3165 series pipe covering protection saddle.

- 4. Insulated Cold piping: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield.
- 5. Copper Tubing Supports Hangers shall be sized to fit copper tubing outside diameters. Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170CT. Malleable iron ring hanger, Type 12, B-Line B3198RCT or hinged ring hanger B3198HCT. Adjustable steel clevis hanger, Type 1, B-Line B3104CT. For supporting copper tube to strut use plastic inserted vibration isolation clamps, B-Line BVT series.
- 6. Plastic Pipe Supports: V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, Type 1, B-Line B3106 and B3106V plastic pipe support channel, to form a continuous support system for plastic pipe or flexible tubing.
- G. Pipe Clamps: When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, Type 4, B-Line B3140. For insulated lines use double bolted pipe clamps, Type 3, B-Line B3144.
- H. Multiple or Trapeze Hanger: Trapeze hangers shall be constructed from 12-gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8-inch minimum, B-Line B22 strut or stronger as required. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B2000 Series.
- I. Wall Supports: Pipes 4" and smaller: Carbon steel J-hanger, B-Line B3690. Pipes larger than 4": Welded strut bracket and pipe straps, Type 31 light welded steel bracket, B-Line B3064. Provide Type 32 or Type 33 for heavier loads.
- J. Floor Supports: Hot piping under 6 inch and cold piping: Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Type 38 adjustable pipe saddle, B-Line B3093 and B3088T base stand; or Type 39, B3090 and B3088 base stand. Pipe saddle shall be screwed or welded to appropriate base stand. Hot piping 6 inch and larger: Adjustable Roller stand with base plate, Type 46, B3118SL. Adjustable roller support and steel support sized for elevation, B-Line B3124.
- K. Vertical Supports: Steel riser clamp sized to fit OD of pipe, Type 8, B-Line B3373.
- L. Supplementary Structural Supports: Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12 gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.
- M. Beam Clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration. C-Clamps shall have locknuts and cup point set screws, Type 23, B-Line B351L. Refer to manufacturer's recommendation for setscrew torque. Retaining straps shall be used to maintain the clamps position on the beam where required.
- N. Concrete Inserts: Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, Type 18, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon

steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.

- O. For air conditioning and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon inserted locknut. For copper and steel tubing use B-Line BVT-Series Vibraclamps. For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required. For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts as required.
- P. Accessories
  - 1. Hanger Rods shall be threaded both ends, or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
  - 2. Shields shall be 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.
  - 3. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.
- Q. Indoor Finishes: Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633; or shall have an electro-deposited green epoxy finish, B-Line Dura-Green®. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green®.
- R. Outdoor Finishes: Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. Hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
- S. Unistrut (MFMA) Manufacturer Metal Framing System:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Unistrut Corporation
    - b. Cooper B-Line, Inc.
    - c. Flex-Strut Inc.
    - d. Thomas & Betts Corporation.
  - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes. Standard: MFMA-4.
  - 3. Channels: Continuous slotted steel channel with in-turned lips. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

- 4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- 5. Coating: Unistrut Perma-green or similar.

### 2.8 BRAIDED EXPANSION LOOPS (MANUFACTURED ONLY, NO FIELD FABRICATED)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Metraflex Co.
  - b. Flex Hose Co., Inc.
  - c. Flexicraft
- B. Flexible loops shall consist of two flexible sections of hose and braid, two 90° elbows, and an 180° return assembled in such a way that the piping does not change direction but maintains its course along a single axis. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be provided in a neutral, pre-compressed or pre-extended condition as required for the application. For steam service, loops must be provided with flexible legs horizontal to prevent condensate buildup. Provide and guide per manufacturer's recommendations. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings. For natural gas service, connectors shall be A.G.A. certified. Basis of Design: Flexible expansion loops to be "Metraloop" as manufactured by the Metraflex Company.
- C. Loops for domestic hot water shall be NSF-372 lead free certified.
- D. For tight pipe runs, provide nested loops.
- E. Anchors: Metraflex Model PA anchor clamp or approved equal. Provide light weight anchor for low load; compatible with braided expansion loop manufactures recommendations for "no-thrust" expansion joints. Clamp to pipe.
- F. Guides: Metraflex Model PGIV shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two section guide spider, having 1/8" maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of the spider.

#### 2.9 THERMOMETERS AND PRESSURE GAUGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft
  - 2. Weksler
  - 3. Ernst Gauge Co.
  - 4. Trerice: H. O. Trerice Co.
  - 5. Weiss Instruments, Inc.

- B. The proper range will be selected so that the operating temperature/pressure of the material being measured will fall approximately in the middle of the scale.
- C. Liquid-In-Glass Industrial Thermometers: shall be a blue reading (Fill Type Spirit: Blue colored, organic) liquid-in-glass adjustable angle type, 9" scale, cast aluminum case with cured polyester powder coating, clear acrylic window and brass separable thermowell. Thermometers will be Trerice BX9 Series or approved equal.
- D. Thermowells: Provide fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem. Material shall be compatible with the piping. Where insulation thickness exceeds 2", a longer stem thermometer will be used with an extension neck brass separable thermowell. The extension neck will be at least 2" long. Cap: Threaded, with chain permanently fastened to socket.
- E. Pressure gauges shall be  $3\frac{1}{2}$ " dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. The movement will be brass with a bronze bourdon tube and brass socket. The dial face will be white with black figures; pointer will be friction adjustable type. Accuracy shall be  $\pm 1\%$  of scale range, ASME B40.1 Grade 1A. Pressure gauges will be Trerice No. 600CB approved equal.
  - 1. Connector: Brass, NPT 1/4.
  - 2. Units of Measure: PSI
  - 3. Provide silicone-damped movement.
  - 4. Provide pressure-gauge needle valve and snubber (Trerice No. 872 pressure snubbers) in piping to pressure gauges; ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
  - 5. Needle Valves: Trerice 735 Series; NPS 1/4 brass or 316 stainless steel needle type.

# 2.10 MISCELLANEOUS

- A. Grout: ASTM C 1107, Grade B, non-shrink, and nonmetallic, dry hydraulic-cement grout. Characteristics: Post-hardening, volume adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications. Design Mix: 5000-psi, 28-day compressive strength. Packaging: Premixed and factory packaged.
- B. Equipment shall be vibration isolated to prevent vibration transmission to the building structure.

# PART 3 - EXECUTION

# 3.1 DEMOLITION AND REMOVALS

- A. Refer to Division 1 for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing and mechanical 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. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap and seal remaining ducts with same or compatible ductwork material.
- 4. Ducts to Be Abandoned in Place: Cap and seal ducts with same or compatible ductwork material.
- 5. Equipment to be Removed: Disconnect and cap services and remove equipment.
- 6. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- 7. 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 COMMON REQUIREMENTS

- A. Work shall be conducted, installed, and completed in a neat and professional manner reflecting a minimum level of competent workmanship.
- B. The drawings show the general arrangement of systems and equipment but do not show all required fittings and offsets that may be necessary to connect pipes and ductwork to equipment, and to coordinate with other trades. Provide necessary fittings, offsets and runs based on field measurements and at no additional cost. Coordinate with other trades for space available and relative location of equipment and accessories. Pipe and duct location on the drawings shall be altered by the contractor where necessary to avoid interferences and clearance difficulties.
- C. Fabricate based on field measurements.
- D. Corrections or comments made on the shop or coordination drawings during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades; and performing work in a safe and satisfactory manner.
- E. Protection and Cleaning: Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items shall be replaced. Protect finished parts of equipment. Close duct and pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of work thoroughly clean fixtures, exposed materials, and equipment.
- F. Provide piping, ductwork, and equipment to allow maximum headroom unless specific mounting heights are indicated. Provide equipment level and plumb, parallel, and perpendicular
to other building systems and components in exposed interior spaces, unless otherwise indicated.

- G. Provide equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- H. Coordinate location of piping, ductwork, sleeves, inserts, hangers, and equipment. Locate to clear other construction, services, and utilities.
- I. Provide piping and ductwork in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- J. Provide systems above accessible ceilings to allow sufficient space for ceiling panel removal.
- K. Verify final equipment locations for roughing-in.
- L. Do not enclose, cover, or put into operation until inspected and approved by authorities having jurisdiction.
- M. The contract documents indicate required valves, fittings, and accessories. If additional materials are required by code or manufacturer's instructions, they shall be provided at no cost to the owner.
- N. Any hot work operations that are performed during this project shall be permitted by use of the FM Global Hot Work Permit System. The FM Global Hot Work Permit System shall be used to supervise all hot work operations (cutting, welding, brazing, grinding, soldering, etc.,) performed outside of any designated welding areas. A written policy statement shall specify who has the authority to issue permits on all shifts. In addition, a constant fire watch shall be continued for 1 hr. after work is completed and the area shall be monitored for an additional 3 hrs. after that.

#### 3.3 PIPING INSTALLATIONS

- A. Provide 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.
  - 1. Provide piping to permit valve servicing.
  - 2. Provide equipment and other components to allow right of way for piping installed at required slope.
  - 3. Provide free of sags and bends.
  - 4. Provide unions or flanges at connections to equipment.
  - 5. Provide fittings for changes in direction and branch connections.
  - 6. Make allowances for application of insulation.
- B. Provide piping adjacent to equipment and machines to allow service and maintenance.

- C. Use transition fitting to join dissimilar piping materials. Connect piping in sizes indicated, but not smaller than sizes of unit connections.
- D. Select system components with pressure rating equal to or greater than system operating pressure.
- E. Plastic piping: Piping shall be installed to avoid damage from adjacent light fixtures. In certain construction situations, these plastic pipes may be installed near recessed light fixtures in ceilings. Light fixtures may have exterior temperatures as high as 194°F.
- F. Plumbing: General layout shown, provide piping and components as required by the local plumbing code. A licensed master plumber shall perform or supervise the work and provide layouts, piping, and fittings as required by code.

## 3.4 PIPING JOINT CONSTRUCTION

- A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied endcaps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor. Protect fittings, flanges, and piping specialties from moisture and dirt. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- B. Joints shall be fabricated, joined, and tested per the piping and fitting manufacturer's instructions. Joint preparation, setting and alignment, joining process, timing, hanger spacing, and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.
- C. Join pipe and fittings according to the following requirements and the relevant specification section specifying piping systems.
- D. Ream ends of pipes and tubes and remove burrs. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- E. Installer Qualifications
  - 1. Pipe fitters shall be qualified in the procedure used to perform the pipe joining.
  - 2. The contractor is responsible for documenting the qualification and training records of each pipe fitter. Pipe fitters shall have current, formal training on the pipe jointing method.
  - 3. Contractor must submit documentation that lists personnel assigned to this project prior to beginning construction who have successfully completed formal training conducted by an authorized manufacturer's representative. The Contractor Training documentation shall be specific to the manufacturer of the pipe and fittings.
  - 4. Personnel's training documentation must be current and have been updated within the past two (2) years. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.

- 5. Piping Warranty: Contractor shall provide, and document required training and required by the piping system manufacturer in order to maintain the piping manufacturer's warranty.
- F. Provide dielectric isolation at the connection of the dissimilar piping (copper and steel).
- G. 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.
- H. 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/A5.8M.
- I. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
  - 5. 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.
- J. Press connections:
  - 1. The joints shall be pressed using the tools approved by the manufacturer.
  - 2. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint.
  - 3. Pipe ends shall be cut on a right angle (square) to the pipe.
  - 4. Copper: The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tools approved by the manufacturer.
  - 5. Steel: Pipe ends shall be reamed chamfered, and paint, lacquer, grease, oil, or dirt shall be removed from the pipe end with an abrasive cloth, or with the Rigid MegaPress pipe end prep tool. Sealing elements shall be verified for the intended use. Visually examine the fitting sealing element to ensure there is no damage. Utilizing a Viega insertion depth inspection gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting.
- K. PEX Joints: Provide per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for F1960 connections.
- L. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators. Bevel plain ends of steel pipe. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- M. Flanged Joints: Provide appropriate gasket material, size, type, and thickness for service application. Provide gasket concentrically positioned. Use suitable lubricants on bolt threads.

N. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix. PVC Piping: Join according to ASTM D 2855.

# 3.5 PIPE PENETRATIONS, SLEEVES, & ESCUTCHEONS

- A. Pipe penetrations shall be sealed, provide sealants for pipe penetrations
- B. Provide allowance for thermal expansion and contraction of copper tubing passing through a wall, floor, ceiling, or partition by wrapping with an approved tape or pipe insulation or by installing through an appropriately sized sleeve.
- C. Sleeve Clearance: Sleeve through floors, walls, partitions, and beams shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation.
- D. Provide sleeves for pipes passing through concrete and masonry construction. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint. Cut sleeves to length for mounting flush with both surfaces. Provide sleeves in new walls and slabs as new walls and slabs are constructed. Provide steel pipe sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Piping through concrete or masonry shall not be subject to any load from the building construction.
  - 1. Sleeves are not required in drywall construction.
  - 2. Sleeves are not required for core-drilled holes. Provide core drilling as required.
- E. To prevent accidental liquid spills from passing to a lower level, provide the following:
  - 1. For sleeves: Extend sleeve 1-1/2 inch above finished floor and provide sealant for watertight joint.
  - 2. For blocked out floor openings: Provide 1-1/2 inch angle set in silicone adhesive around opening.
  - 3. For drilled penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- F. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 7.
- G. Exterior- Pipe Penetrations: Provide sleeve-seal systems in sleeves at service piping entries into building. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and provide in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

## H. Escutcheons:

- 1. Provide escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork.
- 2. Provide escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 3. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- I. Plastic and copper piping penetrating framing members, and within one-inch of the framing, shall be protected with 10-gauge steel nailing plates. The steel plate shall extend along the framing member a minimum of 1.5" beyond the OD of the pipe or tubing.

# 3.6 PIPE HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or provide intermediate supports for smaller diameter pipes as specified for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Provide per manufactures recommendations and calculations.
- D. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.
- E. Fastener System Installation: Provide powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Provide fasteners according to powder-actuated tool manufacturer's operating manual. Provide mechanical-expansion anchors in concrete after concrete is placed and completely cured. Provide fasteners according to manufacturer's written instructions.
- F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Provide hangers and supports to allow controlled thermal or 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. Provide lateral bracing with pipe hangers and supports to prevent swaying.

- J. Provide building attachments within concrete slabs or attach to structural steel. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and provide reinforcing bars through openings at top of inserts.
- K. Provide for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow for expansion and contraction, hangers must be placed so as not to restrict this movement
- L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by plumbing code and ASME B31.9 for building services piping. Piping shall be supported in such a manner as to maintain its alignment and prevent sagging.
- M. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- N. Insulated Piping: Attach clamps and spacers to piping.
  - 1. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - 2. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- O. Equipment Supports: Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Grouting: Place grout under supports for equipment and make bearing surface smooth. Provide lateral bracing, to prevent swaying, for equipment supports.
- P. Metal Fabrications: Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- Q. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.
- R. Hanger and Support Schedule
  - 1. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
  - 2. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
  - 3. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

# S. Hanger Spacing

- 1. Support piping and tubing not listed below according to MSS SP-69 and manufacturer's written instructions.
- 2. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading.
- 3. Space and provide hangers with the fewest practical rigid anchor points.
- 4. Piping shall be supported at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or grade reversal.
- 5. Pipe shall be supported at branch ends and at changes of direction.
- 6. Provide hangers for steel piping with the following maximum horizontal spacing and minimum rod sizes:
  - a. NPS <sup>3</sup>/<sub>4</sub> to 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
  - b. NPS 1-1/4: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - e. NPS 2-1/2 to 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  - f. NPS 4 to 5: Maximum span, 10 feet; minimum rod size, 5/8 inch.
  - g. NPS 6 to 8: Maximum span, 10 feet; minimum rod size, 3/4 inch.
  - h. NPS 10 to 12: Maximum span, 10 feet; minimum rod size, 7/8 inch.
- 7. Provide hangers for copper piping with the following maximum horizontal spacing and minimum rod sizes:
  - a. NPS  $\frac{1}{2}$  and  $\frac{3}{4}$ : Maximum span, 5 feet; minimum rod size,  $\frac{1}{4}$  inch.
  - b. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - c. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - d. NPS 1-1/2 to 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - e. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - f. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - g. NPS 4: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  - h. Maximum vertical steel and copper pipe attachment spacing: 10 feet.
- 8. Piping Hangers for Plastic Piping:
  - a. Hangers shall not compress, distort, cut, or abrade the piping.
  - b. Hangers shall be placed next to the pipe joint not more than 18" from the point joint.
  - c. Maximum horizontal spacing and minimum rod diameters (pipe temperature 100°F or lower).
  - d. Solvent cemented PVC
    - 1) NPS 2 and smaller: 48" with 3/8-inch rod.
    - 2) NPS 2-1/2: 48" with 1/2-inch rod.
    - 3) NPS 3: 48" with 1/2-inch rod.
    - 4) NPS 4: 48" with 5/8-inch rod.
    - 5) NPS 6: 48" with 3/4-inch rod.

- 6) NPS 8: 48" with 7/8-inch rod.
- 7) NPS 10: 48" with 7/8-inch rod.
- 8) NPS 12: 48" with 7/8-inch rod.
- e. Solvent cemented CPVC
  - 1) NPS 1 and smaller: 36" with 3/8-inch rod.
  - 2) NPS 1-1/4 to NPS 3: 60" with 3/8-inch rod.
  - 3) NPS 3: 60" with 1/2-inch rod.
  - 4) NPS 4: 60" with 5/8-inch rod.
  - 5) NPS 6 and 8: 60" with 3/4-inch rod.
- 9. Provide supports for vertical piping every 10 feet.

#### T. PEX Piping

- 1. Horizontal PEX-a Piping Hangers: Provide CTS hangers suitable for PEX-a piping in compliance with the manufacturer's instructions and local codes, with the following maximum spacing:
  - a. For UPC Jurisdictions: 1 inch and below: Maximum span, 32 inches.
  - b. For UPC Jurisdictions: 1-1/4 inch and above: Maximum span, 48 inches.
  - c. Note: The above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
- 2. Horizontal PEX-a Piping with PEX-a Pipe Channel: Provide hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
  - a. 3/4 inch and below: Maximum span, 6 feet.
  - b. 1 inch and above: Maximum span, 8 feet.
- 3. Vertical PEX-a Piping: Support PEX-a piping with maximum spacing of 5 feet.
- 4. PEX-a Riser Supports: Provide CTS riser clamps at the base of each floor and at the top of every other floor for domestic hot-water systems. Provide mid-story guides between each floor. Provide CTS riser clamps at the base of each floor and at the top of every fourth floor for domestic cold-water systems. Provide mid-story guides.
- U. Support vertical piping independently of connected horizontal piping. Support vertical pipes at base and at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.
- V. Place a hanger within 12 inches of each horizontal elbow.

# 3.7 VALVE INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's recommendations.
- B. Provide valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown. Locate valves for easy access and provide separate support where necessary.
- C. Provide valves in horizontal piping with stem at or above center of pipe.
- D. Provide valves in position to allow full stem movement.
- E. Provide strainers on supply side of each control valve and elsewhere as indicated or recommended by component manufacturer to have strainer protection. Provide valved drain and hose connection on strainer blow down connection.
  - 1. Provide with provisions for service clearance.
  - 2. Remove and clean strainer after 24 hours of operation and after 30 days of operation.
- F. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be services and removed without interference from structure or other pipes and/or equipment.
- G. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at connections to screw-type control valves.
- H. Provide check valves at each pump discharge and elsewhere as required to control flow direction.
- I. Provide hose end drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

#### 3.8 IDENTIFICATION

- A. Provide equipment markers on each item of scheduled equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated. Locate markers where accessible and visible. Equipment located above the ceiling that requires servicing shall be labeled on the ceiling using a labeling machine.
  - 1. Letters shall be  $\frac{1}{4}$ " high, black.
  - 2. Label equipment above ceiling that requires servicing or access. Locate labels on the ceiling grid, adjacent to the ceiling tile that provides the best access to the valve or item that requires servicing.

# B. Piping Identification:

- 1. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; mechanical rooms; accessible maintenance spaces such as shafts and plenums; and exterior exposed locations as follows:
  - a. Near each valve and control device.
  - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - c. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - d. At access doors and similar access points that permit view of concealed piping.
  - e. Near major equipment items and other points of origination and termination.
  - f. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- 2. Directional Flow Arrows: Arrows shall be provided to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- 3. Apply "Electric Traced" labels to the outside of heat-traced insulation.
- C. Provide tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Mount valve schedule on wall in accessible location in each major equipment room. Provide (2) copies of valve schedules in digital format.
- D. Relocate mechanical identification materials and devices that have become visually blocked by other work. Clean faces of mechanical identification devices.

# 3.9 THERMOMETERS AND PRESSURE GAUGES

- A. Provide thermometers and adjust vertical and tilted positions. Provide thermowells with extension on insulated piping. Provide separable sockets in vertical position in piping tees.
- B. Provide pressure gauges in piping tees with pressure-gauge valve located on pipe at most readable position. Provide valve and snubber in piping for each pressure gage for fluids.
- C. Calibrate according to manufacturer's written instructions, after installation.
- D. Adjust faces to proper angle for best visibility. Clean windows and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

### 3.10 BRAIDED EXPANSION LOOP INSTALLATION

- A. Provide and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installations". Flexible hose expansion loop return fittings shall be supported to allow movement.
- B. Nesting Clearance. Often several Metraloops are nested inside of each other, when this is the case, the installer shall verify that there is enough clearance between the Metraloops after insulation to allow for the full expected movement.
- C. Provide pipe anchors according to expansion fitting manufacturer's written instructions.
  - 1. Provide anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
  - 2. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
  - 4. Concrete Anchors: Attach by fasteners, follow fastener manufacturer's written instructions.
- D. A pipe guide shall be provided anywhere within 15 pipe diameters on each side of the braided expansion loop. Loops anchored on one side need only one guide on the traveling side. Attach guides to pipe and secure to building structure.

## 3.11 ERECTION OF SUPPORTS AND ANCHORAGES

- A. Fasten wall-hanging items securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated. Fasten recessed-type items to reinforcement built into walls.
- B. Wood: Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor materials and equipment. 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. Provide fasteners without splitting wood members. Attach to substrates as required to support applied loads.
- C. Metal: Provide in accordance with Division 5. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor materials and equipment. Field Welding: Comply with AWS D1.1.
- D. Grouting: Provide per manufacturer's instructions. Mix and provide grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors. Clean surfaces that will come into contact with grout. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout. Place grout, completely filling equipment bases. Place grout on concrete bases and provide smooth bearing surface for equipment. Place grout around anchors. Cure placed grout.

## 3.12 FIRESTOPPING

A. Provide through-penetration firestop systems. Refer to Division 7 for materials. Seal penetrations through fire-or smoke-rated wall, partition, ceiling, or roof assemblies with firestopping systems. Refer to Architectural plans for location of rated assemblies.

### 3.13 PAINTING

- A. Painting of plumbing and mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.14 ROOFING

- A. Refer to Division 7.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Roof Pipe Stand Installation: Provide per manufactures recommendations and calculations. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount them on a smooth roof surface. Do not penetrate roof membrane. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- D. Roof Pipe Penetrations: Provide curb system with cover and pipe boots.
- E. Do not locate mechanical equipment within 10 feet of the roof edge.
- F. Roof Edge Fall Protection: Basis of Design: Keegard "Rooftop Guardrail for Narrow Spaces", or equal. Provide freestanding/non-penetrating roof edge protection system, including pipe railings, uprights, bases, counterweights, and fittings. Freestanding counterweighted guardrail system with 42 inches minimum height to provide a pedestrian egress barrier on the roof to withstand a minimum load of 200 lb. in any direction to the top rail per OSHA Regulation 29 CFR 1910.23. Pipe: Steel, 1-1/2 inches schedule 40, galvanized, galvanized or stainless steel construction. Provide galvanized steel bases are galvanized with a rubber pad on underside of the component (set on roof, without disturbing existing adhered roof membrane).

## 3.15 PROJECT CLOSEOUT

- A. Starting and Adjusting
  - 1. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace them with new units, and retest.
  - 2. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

- 3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 4. Provide commissioning per manufacturer's instructions. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning.
- 5. Start-up shall not be considered complete until the sequence of operation, including alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.
- B. Follow Closeout procedures as per Division 1.
- C. Provide Demonstration and Training in accordance Division 1.
- D. Provide Project Record Documents in accordance with Division 1. In addition, per ASHRAE 90.1-2016: Provide record drawings of the actual installation to the building owner. Record drawings shall include, as a minimum, the location and performance data on each piece of equipment; general configuration of the duct and pipe distribution system, including sizes; and the terminal air or water design flow rates.
- E. Provide Operation and Maintenance information in accordance with Division 1. In addition, per ASHRAE 90.1: Provide an operating manual and a maintenance manual to the building owner. Manuals shall include, at a minimum, the following:
  - 1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
  - 2. Operation manuals and maintenance manuals for each piece of equipment and system requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
  - 3. Names and addresses of at least one service agency.
  - 4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.

END OF SECTION 230500

# SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division Section: "Common Work Results"

### 1.2 SUMMARY

A. Testing, Adjusting, and Balancing

### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Reports:
  - 1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.
  - 2. TAB Report: Submit the complete testing, adjusting, and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.
  - 3. Reports shall be on TABB/SMACNA, AABC, or NEBB forms that indicate information addressing each of the testing methods, readings, and adjustments.
- C. Closeout Submittals: Provide complete copy of TAB report. Include report in Operation and Maintenance Manual.

#### 1.4 QUALITY ASSURANCE

- A. An independent entity shall perform the TAB work.
- B. Special Warranty

- 1. Provide warranty for period of 90 days following submission of completed report, during which time Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.
- 2. Warranty shall meet the requirements of the following programs:
  - a. TABB Quality Assurance Program
  - b. AABC National Project Performance Guarantee
  - c. NEBB Conformance Certification
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 "System Balancing."
- E. TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

## 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.
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed, complete, and operable.
  - 3. Verify HVAC control system is operating within the design limitations.
  - 4. Confirm that the sequences of operation comply with Contract Documents.
  - 5. Automatic and manual dampers are operable and fully open.
  - 6. Verify that controllers are calibrated and function as intended.
  - 7. Verify that controller set points are as indicated.
  - 8. Verify the operation of lockout or interlock systems.
  - 9. Verify the operation of valve and damper actuators.
  - 10. Verify that controlled devices are properly installed and connected to correct controller.
  - 11. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
  - 12. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
  - 13. Suitable access to balancing devices and equipment is provided.
  - 14. Thermal overload protection is in place for equipment.
  - 15. Start-up air filters are removed.
  - 16. Final filters are clean and properly installed.
  - 17. Duct and fan systems are clean.
  - 18. Fans are rotating correctly.

- 19. Life safety and volume dampers are in place and open.
- 20. Air coil fins are cleaned and combed.
- 21. Access doors are closed, and duct end caps are in place.
- 22. Air outlets are installed and connected.
- 23. Hydronic systems are pressure tested, flushed, filled, and properly vented.
- 24. Leak testing on duct system has been performed.
- 25. Pumps are rotating correctly.
- 26. Start-up/construction strainers have been removed and all permanent strainers are clean and in place.
- 27. Gauges and/or test ports are properly located for balancing.
- 28. Service and balance valves are fully open.
- B. If deficiencies are evident, submit Deficiency Report to Architect. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied.

### 3.2 AIR SYSTEMS PROCEDURES

- A. Adhere to the follow procedure:
  - 1. TABB SMACNA TAB Procedural Guide, with particular focus on the following chapters: Preliminary TAB Procedures, General Air System TAB Procedures, & TABB Procedures for Specific Air Systems.
  - 2. AABC National Standards for Total System Balance.
  - 3. NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- B. Minimum air procedures shall include the following:
  - 1. Provide TAB for all air systems and components.
  - 2. Test and adjust fan RPM to design requirements.
  - 3. Test and record motor full load nameplate rating and actual ampere draw.
  - 4. Test and record system static pressures, fan suction, and discharge.
  - 5. Adjust all main supply and return air duct to within tolerances of proper design CFM.
  - 6. Test and adjust each diffuser, grille, and register. Reading and tests of diffusers, grilles, and registers shall include design velocity (FPM) and adjusted velocity, design CFM, and adjusted CFM.
  - 7. Test and record outside air, mixed air, and discharge temperatures (D.B. for heating cycle, D.B. and W.B. for cooling cycle).
  - 8. In coordination with the BAS contractor, set adjustments of automatically operated dampers to operate as specified, indicated and/or noted.
  - 9. Test and adjust air handling and distribution systems to provide required supply, return, outside, and exhaust air quantities within design tolerance.
  - 10. Make air velocity measurements in ducts by Pitot tube traverse across entire crosssectional area of duct in accordance with SMACNA equal area method or Log Linear method.
  - 11. Measure air quantities at all air inlets and outlets.
  - 12. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels.

- 13. Vary total system air quantities by adjustment of fan speeds. Provide drive changes recommendations. Vary branch air quantities by damper regulation.
- 14. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for loading of filters and coils.
- 15. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions within specified tolerances.
- 16. Where modulating dampers or economizers are provided, take measurement at full return air, minimum outside air, and 100% outside air mode of operation.
- 17. For airflow monitoring devices to perform as intended, field calibration is required. Provide measurement of airflow to assist with calibration.
- C. Set system's airflow rates within the following tolerances:
  - 1. Air Handling Systems: Adjust to within plus 10 percent of outlet total plus allowable leakage rate.
  - 2. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design for the space.
  - 3. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

# 3.3 HYDRONIC SYSTEM PROCEDURES

- A. Adhere to the follow procedure:
  - 1. TABB SMACNA TAB Procedural Guide, with particular focus on the following chapter: Hydronic System TAB Procedures.
  - 2. AABC National Standards for Total System Balance.
  - 3. NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- B. Hydronic balancing shall include the following minimum data:
  - 1. Provide TAB for all hydronic systems and components.
  - 2. Prepare itemized equipment schedules listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating and/or cooling elements, all zone balancing valves, and circuit pumps, ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions, and measured conditions. Prepare individual pump report sheets for each zone or circuit.
  - 3. Adjust hydronic systems to provide plus or minus 10 percent of required design quantities.
  - 4. Use calibrated Venturi tubes, orifices, metered fittings, pressure gages, and directreading instrumentation to determine flow rates for system balance. Where flowmetering devices are not installed, flow balance on temperature difference across various heat transfer elements in the system is acceptable.
  - 5. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

- 6. Effect system balance with automatic control valves fully open to heat or cooling transfer elements.
- 7. Adjust hydronic distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- 8. Test pumps and adjust flow. Record the following on pump report sheets:
  - a. Suction and discharge pressure.
  - b. Running amps and brake horsepower of pump motor under full flow and no flow conditions.
  - c. Pressure-drop across pump in feet of water and total GPM pump is handling under full flow conditions.
- 9. Where available pump capacity is less than total flow requirements or individual system parts, proportional balancing must be performed.
- C. Set system's water flow rates within the following tolerances:
  - 1. Hydronic Systems: Adjust to within 10 percent of design flow.
  - 2. Hydronic terminal devices: Adjust to within plus or minus 10 percent of design flow.

# 3.4 ADJUSTING

- A. Recorded data shall represent actual measured or observed conditions.
- B. Permanently mark the setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- C. Final report to include identification of all key outlets, key branches, and key trunks in each air system that shows a critical path of no dampening from the fan to terminal device.
- D. Final report to include identification of all key terminal devices, key branches, and key trunks in each hydronic system that shows a critical path of no throttling of valves from the pump to terminal device.
- E. Leave systems in proper working order by replacing guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

## END OF SECTION 230593

SECTION 230700 – MECHANICAL INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 7 for firestopping materials and requirements for penetrations through fire and smoke barriers.
  - 2. Division 23 Section "Common Work Results for Mechanical"

### 1.2 SUMMARY

A. This Section includes insulation and related components for Division 22 & Division 23.

### 1.3 ACTION SUBMITTALS

A. Product Data: Identify thermal conductivity, Greenguard Certification, thickness, and jackets (both factory and field applied, if any), for each type of product indicated. For adhesives and sealants, provide documentation including printed a statement of VOC content.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
- C. Indoors: Materials shall have a flame spread index of less than 25 and a smoke developed index of less than 50 when tested in accordance with ASTM E 84, latest revision.
- D. Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- E. Provide accessory materials as part of insulation work under his section shall include closure materials, adhesives, mastics, and support materials; shall be as recommended by insulation material manufacturer.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.
- B. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- C. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer.
- D. Follow manufacturer's recommended handling practices.
- E. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- F. Fiber Glass and Mold: Contractor shall take precaution to protect insulation. Any fiber glass insulation that becomes wet or torn should be replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.

#### 1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields. Coordinate clearance requirements with other trades for insulation application.
- B. Schedule insulation application after testing systems. Insulation application may begin on segments of systems that have satisfactory test results.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Certainteed
  - 2. Knauf
  - 3. Owens-Corning
  - 4. John Mansville
  - 5. Armstrong
  - 6. Aeroflex USA
  - 7. Nomaco K-Flex
  - 8. Pabco.

## 2.2 PIPING INSULATION MATERIALS

- A. Glass Fiber:
  - 1. Knauf 1000° Pipe Insulation with ECOSE Technology meeting ASTM C547 Type IV Grade A, ASTM C585, and ASTM C795; rigid, molded, noncombustible per ASTM E136; k value: ASTM C335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F, or Johns Manville's Micro-Lok<sup>®</sup> *HP* meeting ASTM C547, Type I, maximum service temperature of 850°F meeting the other requirements. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C1136 Type I, secured with self-sealing longitudinal laps and butt strips.
  - 2. PVC Fitting Covers: The Proto Fitting Cover System or Johns Manville Zeston<sup>®</sup> polyvinyl chloride (PVC) parts shall consist of one piece and two piece pre-molded high impact UV-resistant PVC fitting covers with fiberglass inserts and accessories, which include elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings. Fittings shall be made of Zeston<sup>®</sup> or LoSMOKE® grade PVC, 25/50 rated per ASTM E-84. Thermal Value of fiberglass insert: K value of 0.26 at 75°F; resistance to fungi and bacteria. (ASTM G 21, ASTM G 22): does not promote growth of fungi or bacteria.
- B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - 3. Materials shall have a maximum thermal conductivity of 0.27 Btu-in/h-ft2- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
  - 4. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure-A, latest revision.
  - 5. Provide Armaflex WB finish for outdoor exposed piping.
- C. Closed Cell Pipe Insulation: Pittsburgh Corning Foamglas, or approved equal; a lightweight, rigid insulating material composed of millions of completely sealed glass cells, each an insulating space. ASTM C 552-00 "Specification for Cellular Glass Thermal Insulation" operating temperatures from -450°F to +900°F; water permeability 0.00 perm-inch.
- D. Field-Applied Jackets For Piping: ASTM C 921, Type 1, unless otherwise indicated.
  - 1. PVC: Johns Manville's Zeston<sup>®</sup> PVC fittings, jacketing, and accessories or Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white. The fitting cover system consists of pre-molded, high-impact PVC materials with fiber glass inserts. Fiber glass insert has a thermal conductivity (k value) of 0.26 at 75° F mean temperature. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
  - 2. Metal jackets: provide with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant

recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

- 3. Aluminum Jacket: Factory cut and rolled to required size. Comply with ASTM B 209, 3003 alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and Kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
- 4. Stainless-Steel Jacket: ASTM A666, Type 304 or 316; 0.10 inch thick; and factory cut and rolled to required size. Moisture Barrier: 3-mil- thick, heat-bonded polyethylene and Kraft paper. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.
- E. "NO SWEAT" valve wraps. The removable and reusable wraps provide an ongoing protective covering to insulated valves. The valve wrap shall have a 1" thick fiberglass blanket insert to completely cover the insulated valve. The outer cover shall be made of DuPont Tychem QC that easily stretches around the insulated valve and is secured with a Velcro closure. Tychem QC consists of a durable Tyvek substrate quality coated with polyethylene.
  - 1. Temperature Limits: 0°F to 450°F
  - 2. Sanitary/Odorless: Will not absorb odors. Provides no food for insects, rodents, or mildew. Resistant to fungi and bacteria. Does not promote mold growth.
  - 3. Jacket shall be impermeable to water.
  - 4. UV Resistant: Use indoors or outdoors.
  - 5. Long Lasting: Can be used and re-used once applied.
  - 6. Vibration Resistant: Will not settle or separate.
  - 7. Fire Safety: DuPont Tychem ® QC fabric is rated as "Class 1: Normal Flammability" with no unusual burning characteristics. The removable valve wrap fiberglass insulation inserts shall have a UL25/50 rating and are non-combustible per ASTM E 136.

# 2.3 DUCTWORK INSULATION MATERIALS

- A. Flexible Fiber Glass Blanket: Glass Mineral Wool Blanket Insulation: Glass Mineral Wool bonded with a bio-based thermosetting resin. Comply with ASTM C 553, Types I, II, and III, ASTM C 1136 Type II, and ASTM C 1290, Type III. UL/ULC Classified per UL 723 for FSK, FHC 25/50 per ASTM E 84 for PSK only.
  - 1. Factory-applied jacket: ASJ: White, Kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; Atmosphere Duct Wrap.
  - 3. Density: 1.5 PCF
  - 4. R-Value: R6.0 minimum for 1-1/2" thick blanket (k=0.25).
- B. Rigid Fiber Glass Board: Johns Manville's 817 Series Spin-Glass<sup>®</sup> or Knauf Insulation Board with ECOSE Technology meeting ASTM C 612 Type IA and IB; rigid. Maximum Service Temperature: 450°. Density: Minimum 3.0 PCF; R4.2 per inch. Vapor Retarder Jacket: ASJ conforming to ASTM C1136 Type I, or FSK or PSK conforming to ASTM C1136 Type II in combination with protective jacket where necessary. R-Value: R6.0 minimum for 1-1/2" thick blanket (k=0.25).

# C. Exterior Ductwork:

- 1. Insulation: Rigid foam insulating sheathing, complying with ASTM C 1289; closed cell polyisocyanurate, CFC- and HCFC-free.
  - a. Thermal Resistance, ASTM C 518: R12 Minimum.
  - b. Compressive Strength, ASTM D 1621: 16 psi or greater.
  - c. Flexural Strength, ASTM C 203: 40 psi or greater.
  - d. Water Absorption, ASTM C 209: 0.1 percent by volume.
  - e. Water Vapor Permeance, ASTM E 96, 0.05 perms.
- 2. High-performance jacketing: VentureClad-1577, Polygard-Alumagard All-Weather, or approved equal; high performance jacketing product shall perform well over a wide temperature range; -30°F to +300°F service temperature.
  - a. Zero permeability, absolute vapor barrier; High puncture and tear resistance
  - b. Contain tested and approved mold inhibiting agents.
  - c. A 5-ply self-adhesive material shall be installed easily with no off-site fabrication required. The cold weather acrylic adhesive shall apply easily at temperatures as cold as minus 10°F.
  - d. Flame spread/smoke developed: 10/20 (UL 723)
  - e. 6-mil thickness (PSTC-133); Provide in natural aluminum stucco embossed finish.

# PART 3 - EXECUTION

# 3.1 GENERAL APPLICATION REQUIREMENTS

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature. Insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer. Follow manufacturer's recommended handling practices. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect insulation. Any fiber glass insulation that becomes wet or torn should be replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.
- B. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application. Verify that systems to be insulated have been tested and are free of defects. Verify that surfaces to be insulated are clean and dry. Proceed with installation only after unsatisfactory conditions have been corrected. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin. Ensure that pipe and fitting surfaces over which

insulation is to be installed are clean and dry. Ensure that insulation is clean, dry, and in good mechanical condition with factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

- C. Installer Qualifications: Skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- Provide insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout, including the length of ducts and fittings, valves, and specialties. Provide per "National Commercial & Industrial Insulation Standards" MICA Manual.
- E. Provide insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each system as specified in insulation system schedules.
- F. Provide accessories compatible with insulation materials and suitable for the service.
- G. Provide insulation with longitudinal seams at top and bottom of horizontal pipe runs and equipment. Provide multiple layers of insulation with longitudinal and end seams staggered.
- H. There shall be no glass fibers exposed to the air. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- J. Jackets And Finishes: Draw jacket tight and smooth. Cover circumferential joints with 3-inchwide 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. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c. For below ambient services, apply vaporbarrier mastic over staples. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- K. Keep insulation materials dry during application and finishing.
- L. Provide insulation over fittings, valves, and specialties, with continuous thermal and the least number of joints practical.
- M. Provide removable insulation covers at fittings and equipment that require servicing and locations with service requirements.
- N. Locate seams in the least visible location.
- O. Cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal.

- 1. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- 2. Hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.
- 3. Seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- 4. Provide insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity.
- 5. 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. Provide insert materials and provide insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- 6. Provide No-Sweat valve wraps at all chilled water valves and fittings.
- P. For above-ambient services, do not install insulation to the following: testing agency labels and stamps, nameplates, and cleanouts.
- Q. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance. If piping type is omitted from list below, provide insulation per energy code or as per similar duty.
- R. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- S. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- T. Insulate instrument connections for specialties (examples: thermometers, sensors, etc.) on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- U. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- V. 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.
- W. Penetrations
  - 1. Division 7 for firestopping materials and requirements for penetrations through fire and smoke barriers.
  - 2. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Provide insulation continuously through walls and partitions.
  - 3. Insulation installation at Roof or Aboveground Exterior Wall Penetrations: Provide insulation continuously through penetrations.

- a. Seal penetrations with flashing sealant.
- b. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, provide insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
- c. Extend jacket of outdoor insulation outside roof/wall flashing at least 2 inches below top of roof flashing.
- d. Seal jacket to roof/wall flashing with flashing sealant.
- 4. Insulation Installation at Fire-Rated Penetrations:
  - a. Fire Dampers: 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.
  - b. Pipe or duct penetrations (no fire damper): Provide insulation continuously through penetrations of fire-rated walls and partitions. Comply with requirements in Division 7 for firestopping and fire-resistive joint sealers.

# 3.2 INSTALLATION OF PIPING INSULATION

- A. Metal shields shall be provided between hangers or supports and the piping insulation.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Provide No-Sweat valve wraps at all valves and fittings on chilled water piping.
  - 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 and 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 close to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate 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.
  - 5. For below-ambient services, provide a design that maintains vapor barrier.
  - 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Provide 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.
  - 7. 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.
  - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, provide 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.

# C. Flexible Elastomeric Insulation

- 1. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 2. Insulation Installation on Pipe Flanges: Provide pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. 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. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3. Insulation Installation on Pipe Fittings and Elbows: Provide mitered sections of pipe insulation. 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.
- 4. Insulation Installation on Valves and Pipe Specialties: Provide preformed valve covers manufactured of the same material as pipe insulation when available. When preformed valve covers are not available, provide 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. Provide insulation to flanges as specified for flange insulation application. 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.
- 5. After the adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating. Prior to applying the finish, the insulation shall be wiped clean with denatured alcohol. The finish shall not be tinted. To insure good adhesion, the temperature should be above 50°F during application and drying.
- 6. Outdoor exposed piping shall be painted with two coats of Armaflex WB Finish. Prior to applying the Finish, the insulation shall be wiped clean with denatured alcohol. The Finish shall not be tinted. Outdoor exposed piping shall have seams located on the lower half of the pipe.

# 3.3 PIPE APPLICATION SCHEDULE

- A. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements. For piping systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- B. PVC jackets shall be provided with 1-inch overlap at longitudinal seams and end joints, for horizontal applications. Seal with manufacturers recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge. Provide PVC jackets in the following locations:
  - 1. For piping exposed in mechanical rooms within 6 feet above finished floor or high traffic areas.
  - 2. Exposed vertical piping in finished spaces.

- C. AC pan drain or other cold drain piping: Flexible Elastomeric, ½" thickness.
- D. Chilled Water:
  - 1. Pipe size 1-1/4" and less: Flexible Elastomeric,  $\frac{1}{2}$ " thickness.
  - 2. Pipe size 1-1/2" and larger: Flexible Elastomeric, 1" thickness.
  - 3. Chilled Water, outdoors: Flexible Elastomeric Insulation; 2" thickness. Provide aluminum jacket.
- E. Heating hot water supply and return:
  - 1. Pipe size 1-1/4" and less: Glass Fiber; 1-1/2" thickness.
  - 2. Pipe size 1-1/2" and larger: Glass Fiber; 2" thickness.
  - 3. Insulation is not required for exposed piping through floor for convectors and radiators.
  - 4. Insulation is not required strainers, control valves, unions, and balancing valves associated with piping 1" or less diameter. Insulate piping to within approximately 3/4-inch of un-insulated items.

# 3.4 INSTALLATION OF DUCTWORK INSULATION

- A. Flexible Fiberglass Blanket Insulation Installation:
  - 1. Secure with adhesive and insulation pins. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces. Apply adhesive to entire circumference of ducts and to surfaces of fittings and transitions.
  - 2. Firmly butt joints.
  - 3. Provide 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.
  - 4. 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.
  - 5. Provide insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Provide 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.
- 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. Apply adhesive to entire circumference of ducts and to surfaces of fittings and transitions.
  - 2. Provide 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.
  - 3. Provide 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. Provide insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

- 4. 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.
- C. For ducts and plenums with surface temperatures below ambient, provide a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Provide vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal. Provide vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- D. Fire-rated insulation system installation: Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating. Insulate duct access panels and doors to achieve the same fire rating as duct.

# 3.5 DUCTWORK APPLICATION SCHEDULE

- A. For duct systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- B. Application schedules identify ductwork thickness, and jacket requirements. For duct systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.
- C. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment: Flex connectors, metal ducts with duct liner, factory-insulated flexible ducts, factory-insulated plenums, casings, and access doors.
- D. Supply Ducts:
  - 1. Concealed or Unconditioned: Flexible Fiber Glass Blanket; 1.5" thickness, R6 minimum.
  - 2. Exposed to heated or non-air conditioned spaces: Flexible Fiber Glass Blanket; 1.5" thickness R6 minimum.
  - 3. Exposed to Air-Conditioned Space: None
- E. Relief, outside air, or exhaust plenums at louvers: Flexible Rigid Fiberglass Board; 2" thickness.
- F. Relief or exhaust ducts within 20 feet of the exterior: Flexible Fiber Glass Blanket; 1.5" thickness, R6 minimum.

- G. Return ducts within conditioned space: None required.
- H. Exterior Supply & Return Ducts: 2-1/2" Rigid Roof Insulation Board with high performance jacket; R12 minimum.
- I. EQUIPMENT / TANK INSULATION
  - 1. For equipment not indicated, insulate to with a similar thickness and type as those specified.
  - 2. Provide insulation over the entire surface of tanks and vessels. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive. Seal longitudinal seams and end joints.
  - 3. For below ambient services, provide a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.
  - 4. Fiber Glass: Apply insulation to the equipment surface with joints firmly butted and as close as possible to the equipment surface. Insulation shall be secured as required with mechanical fasteners or banding material. Fasteners shall be located a maximum of 3" from each edge and spaced no greater than 12" on center. For below ambient systems, vapor retarder jacketing shall overlap a minimum of 2" at seams and be sealed with appropriate pressure-sensitive tape or mastic. Penetrations and facing damage shall be covered with a minimum 2" overlap of tape or mastic.
  - 5. Flexible Elastomeric: Provide insulation over entire surface of tanks and vessels. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive. Seal longitudinal seams and end joints.
  - 6. Pump Insulation
    - a. Insulate pumps by forming a flexible elastomeric box around the pump housing. Construct the box by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Join joints between sides and between sides and bottom by contact adhesive for flexible elastomeric cellular insulation. Ensure box conforms to the requirements of MICA Insulation Standards Plate No. 49. Ensure joints between top cover and sides fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.
    - b. Protect exposed insulation corners with corner angles.
    - c. Provide a complete vapor barrier.
    - d. Provide a parting line between the box and the removable sections allowing the removable sections to be b removed without disturbing the insulation coating. Apply flashing sealant to parting line, between equipment and removable section insulation, and at all penetrations.
  - 7. Omit insulation from the following, except for cold surfaces, which shall be provided with removable covers:
    - a. Hot water expansion tanks
    - b. Hot water pumps
    - c. Vibration-control devices.
    - d. Testing agency labels and stamps.
    - e. Nameplates and data plates.
    - f. Manholes, hand holes, or cleanouts.

- 8. Removable Covers for Maintenance Access: Construct insulation on parts of equipment which must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage.
- 9. Cooling & heating air separators, low loss headers, chemical feed tanks, buffer tanks and similar equipment: same as water piping.

END OF SECTION 230700

## SECTION 230900 – DIRECT DIGITAL CONTROL (DDC) SYSTEM

### PART 1 - GENERAL

### 1.1 SUMMARY

- A. General: The project scope shall serve to replace the existing Building Automation System serving the State Side of the Cumberland County Courthouse (CCCH) and shall be integrated with the existing heating, ventilating, and air conditioning system controls serving the County Side of the CCCH in a manner that provides a single front end for the entire facility while providing upgrades for antiquated systems throughout.
- B. The scope shall specifically include but not necessarily be limited to the following:
  - 1. Replace in its entirety the existing Barbar Colman Network 8000 pneumatic over electric Building Automation System. System replacement shall include new "front end", new application controllers throughout the original building section for the State Side of the CCCH and limited controls integration to existing systems at the County Side of the CCCH as outlined herein.
  - 2. Replace in its entirety, the existing Siemens Vykon Jace and associated application controllers serving the Law Clerk's area at the ground floor.
  - 3. Furnish and install a new application specific controller for the existing package rooftop unit serving the Feeney Conference Room. The new controller shall provide control for the package rooftop unit serving the space, the bypass VAV damper, the heating coil control valves and VAV dampers throughout the system and reheat coil control valves/fintube radiation throughout the suite. The upgrade shall include replacement of the existing duct mounted pressure sensor(s), discharge air temperature sensor, return air temperature sensor, and the global OA temperature sensor serving the system. Actuators at valves and dampers shall be replaced as part of the upgrades. New temperature sensors shall be included to replace existing sensors.
  - 4. Furnish and install a new application controller for the existing Dx split AC unit serving Courtroom 11. The new controller shall provide control for the air handler, condensing unit, and heating coil control valve for the Courtroom. The upgrade shall include replacement of the existing duct mounted pressure sensor(s), discharge air temperature sensor, return air temperature sensor, and the global OA temperature sensor serving the system. Actuators at valves and dampers shall be replaced as part of the upgrades. Replace the existing space thermostat for integration with the new control system.
  - 5. Furnish and install a new application controller for the existing Dx split AC unit serving the Jury Deliberation Area. The new controller shall provide control for the air handler, condensing unit, and reheat coil control valves throughout the system. Furnish and install new temperature sensors-wall mounted to serve the reheat coils associated with this system. The upgrade shall include replacement of the existing duct mounted pressure sensor(s), discharge air temperature sensor, return air temperature sensor, and the global OA temperature sensor serving the system. Actuators at valves and dampers shall be replaced as part of the upgrades.
  - 6. Furnish and install a new application controller to serve the Sallyport Area. The controller shall provide control for the existing ERU and duct mounted heating coil

serving the space. The upgrade shall include replacement of the existing duct mounted pressure sensor(s), discharge air temperature sensor, return air temperature sensor, and the global OA temperature sensor serving the system. Actuators at valves and dampers shall be replaced as part of the upgrades.

- 7. Furnish and install a new application controller to provide complete control for equipment serving the Guard Shack. As with the other systems, the upgrade shall include replacement of sensors and actuators throughout the system.
- 8. Furnish and install new electronic VAV controllers at approximately 70 locations throughout the State side facility.
- 9. Furnish and install new hot water control valve and associated control hardware/software for approximately 70 hot water VAV reheat coils at the State side facility.
- 10. Furnish and install new hot water control valves and actuators with associated hardware/software for control of existing fintube radiation throughout the State side facility.
- 11. Replace the existing wall mounted thermostats throughout the State side facility. This includes those controlling reheat coils, VAV boxes dampers, fintube radiation, etc. At Administrative, Corridor, and Utility spaces, the wall mounted sensors shall be used in place of the existing sensors. At Conference Room and Courtroom areas, duct mounted return air temperature and CO2 sensors shall be installed for control as specified herein, to replace the existing wall mounted sensors.
- 12. Furnish and install new controller(s) as required to start/stop all exhaust fans and open/close associated MOD's at the State side facility (approximately eight fans).
- 13. Furnish and install a new temperature sensor for the domestic hot water supply at both the County Side and State side water heaters for monitoring and high temperature alarm.
- 14. Furnish and install integration to two new smart pumps at the State Side heating hot water system.
- 15. Furnish and install BAS integration via Modbus to the existing Autoflame DTI controller for the steam boiler/burners at the County side.
- 16. Furnish and install BAS integration via Modbus to the existing Autoflame controller for the hot water boiler/burners at the State side.
- 17. Furnish and install upgrades or replacement for the application controller serving the chiller plant at the State side as required for integration to the new BAS. The controller shall provide Bacnet integration to the Daikin chiller control panel and shall control the chilled water pumps, adding variable speed pumping. Provide and install a DP sensor across the chiller barrel, DP sensor across the CHWS/CHWR loop, and a bypass valve to allow for variable speed pumping while maintaining chiller minimum flow requirements. This upgrade shall include replacement for the existing three-way chilled water control valve with a two-way chilled water control valve.
- 18. Furnish and install upgrades or replacement for the application controller serving AC-2, the recently installed rooftop unit as required to provide integration to the new BAS. It is anticipated that existing duct mounted temperature, CO2, and pressure sensors may be retained for interface with the new controller.
- 19. Furnish and install a new controller and all related control devices, actuators, dampers, and valves to provide complete control for the new rooftop unit (AC-1) furnished and installed under the scope of this project. Field installed controls for the AC unit shall include a transducer for the factory installed airflow monitoring station at the OA inlet.
- 20. Furnish and install new VFD's for existing AC-1 return fans. Provide duct mounted static pressure sensor for control of fans as specified in section 230993.
- 21. upgrades or replacement for the application controller(s) serving the condenser water loop at the County side VRF system as required for integration to the new BAS. This

includes control for the variable speed condenser pumps, steam to water heat exchanger, condensing unit control valves, and cooling tower integration for start stop, loop temperature control, basin heaters, etc.

- 22. Bacnet integration to the existing Daikin ITouch Manager associated with the VRF heat pump system serving the County side facility.
- 23. Replace/upgrade the existing Siemens FLN controllers serving the IT room exhaust and IT room cooling only heat pump (HP-11).
- 24. Replace/upgrade the existing Siemens controllers associated with the ERU units (approximately seven units) at the County side facility. This shall include start stop for the units, open/close for the associated MOD's, and discharge air temperature control.
- 25. Furnish and install a CO gas detector in both the State side and County side boiler rooms.
- C. The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.
- D. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- E. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms shall be BACnet objects.
- F. The Controls Contractor's work shall consist of the provision of all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project-specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems. Documents are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner.
- G. Provide all labor, materials, equipment, and service necessary for a complete and operating building automation system.
- H. Related Sections include the following:
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
  - 2. Division 28 Section "Fire Alarm"
  - 3. Division 23 Section "Common Work Results"
  - 4. Division 23 Sections with controller interfaces shall be integrated with the work of this Section.
  - 5. Division 23 Section "Testing, Adjusting, and Balancing"

## 6. Division 26

#### 1.2 SUBMITTALS

- A. Product Data and Shop Drawings: Meet requirements of Division 1. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings in PDF format. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work. Submittal shall include:
  - 1. DDC System Hardware
    - a. A complete bill of materials to be used indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    - b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
      - 1) Direct digital controllers (controller panels)
      - 2) Transducers and transmitters
      - 3) Sensors (including accuracy data)
      - 4) Actuators
      - 5) Valves
      - 6) Relays and switches
      - 7) Control panels
      - 8) Power supplies
      - 9) Batteries
      - 10) Operator interface equipment
      - 11) Wiring
    - c. Wiring diagrams and layouts for each control panel. Show termination numbers.
    - d. Schematic diagrams for all field sensors and controllers. Provide floor plans of all sensor locations and control hardware. Riser diagrams showing control network layout, communication protocol, and wire types.
  - 2. Central System Hardware and Software
    - a. A complete bill of material of equipment used indicating quantity, manufacturer, model number, and relevant technical.
    - b. Manufacturer's description and technical data such as product specifications and installation and maintenance instructions for items listed below and for relevant items furnished under this contract not listed below:

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- 1) Central Processing Unit (CPU) or web server
- 2) Monitors
- 3) Keyboards
- 4) Power supplies
- 5) Battery backups
- 6) Interface equipment between CPU or server and control panels
- 7) Operating System software
- 8) Operator interface software
- 9) Color graphic software
- 10) Third-party software
- c. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show interface wiring to control system.
- d. Network riser diagrams of wiring between central control unit and control panels.
- 3. Controlled Systems
  - a. Riser diagrams showing control network layout, communication protocol, and wire types.
  - b. A schematic diagram of each controlled system. The schematics shall have all control points labeled with point names shown or listed. The schematics shall graphically show the location of all control elements in the system.
  - c. A schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
  - d. An instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
  - e. A mounting, wiring, and routing plan-view drawing. The design shall take into account HVAC, electrical, and other systems' design and elevation requirements.
  - f. A complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system.
  - g. A point list for each control system. Indicate alarmed and trended points.
- 4. Quantities of items submitted shall be reviewed but are the responsibility of the Contractor.
- 5. BACnet Protocol Implementation Conformance Statement (PICS) for each submitted type of controller and operator interface.

## B. Schedules

- 1. Within one month of contract award, provide a schedule of the work indicating the following:
  - a. Intended sequence of work items
  - b. Start date of each work item
  - c. Duration of each work item
- d. Planned delivery dates for ordered material and equipment and expected lead times.
- e. Milestones indicating possible restraints on work by other trades or situations.
- 2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.
- C. Project Record Documents. Upon completion of installation, submit three copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and shall include:
  - 1. Project Record Drawings. As-built versions of submittal shop drawings provided as AutoCAD compatible files on magnetic or optical media (file format: .DWG, .DXF, .VSD, or comparable) and as 11" x 17" prints.
  - 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs.
  - 3. Operation and Maintenance (O&M) Manual.
  - 4. As-built versions of submittal product data.
  - 5. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
  - 6. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
  - 7. Programming manual or set of manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
  - 8. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
  - 9. Documentation of programs created using custom programming language including setpoints, tuning parameters, and object database. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
  - 10. Graphic files, programs, and database on magnetic or optical media.
  - 11. List of recommended spare parts with part numbers and suppliers.
  - 12. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
  - 13. Complete original-issue copies of furnished software, including operating systems, custom programming language, operator workstation or web server software, and graphics software.
  - 14. Licenses, guarantees, and warranty documents for equipment and systems.
  - 15. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
  - 16. Training Materials: Provide course outline and materials for each class at least six weeks before first class. Training shall be furnished via instructor-led sessions, computer-based training, or web-based training.

#### 1.3 QUALITY ASSURANCE

- A. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the owner's representative in writing. Spare parts shall be available for at least five years after completion of this contract.
- B. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer. Use only employees who are qualified, skilled, experienced, manufacturer trained and familiar with the specific equipment, software and configurations to be provided for this Project.
  - 1. Installer shall have an established working relationship with Control System Manufacturer.
  - 2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.
- C. Provide a complete, neat and workmanlike installation.
- D. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- 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. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- G. Comply with ASHRAE 135 for DDC system control components.
- H. The contractor shall protect all work and material from damage by his/her work or employees. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

# **1.4** CONTRACTOR QUALIFICATIONS

A. It is the owners expressed goal to implement an open Building Automation System that will allow products from different manufacturers and/or suppliers to be integrated into a single unified system as necessary to be compatible with the existing system where required, and provide flexibility for expansion, maintenance, and service of the system. For the purpose of this BID, the basis of design for the Building Automation System is Distech Controls as furnished and installed by Maine Controls. This system was selected as the basis of design based upon their current presence within the facility. The specifications herein, however, are not

intended to be proprietary and shall be open to alternate vendors and bidders provided they meet the intent specified herein.

- B. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- C. The above list of manufacturers applies to operator workstation software, controller software, the custom application programming language, and controllers. All other products specified herein (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.
- D. Longevity: The Facilities Management System contractor shall have a minimum of ten years' experience installing and servicing computerized Building Automation Systems (BAS). All subcontractors utilized by the BAS contractor shall have a minimum of five-year experience within their appropriate trades.
- E. Past Projects: The BAS contractor shall have completed a minimum of ten projects within the last five years that are at least equal in dollar value and scope to this project. A list of similar projects, dollar volume, scope, contact name and contact number shall be provided by the BAS contractor if asked for by the owner.
- F. Personnel, Coverage and Response Capabilities: The BAS contractor shall have a minimum of ten full time electronic service personnel within a 120-mile radius of the project location. One of the five full time electronic service personnel must work within a 60-mile radius of the project location.
- G. The BAS contractor shall have an established 24-hour emergency service organization. A dedicated telephone number shall be provided to the owner for requesting emergency service. A maximum of four-hour, electronic service technician on sight, response time shall be guaranteed by the BAS contractor.
- H. Parts Stocking: The BAS contractor shall have an independently verifiable inventory of electronic service parts. This electronic service parts inventory must have a worth of at least \$100,000 per year over the last five years.

# 1.5 COORDINATION

- A. Where the mechanical work will be installed near, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition.
- B. Coordinate details of telephone line, internet service provider, and associated requirements.
- C. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

- D. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the controls system specified in this section. These controls shall be integrated into the system and coordinated by the contractor.
- F. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.
- G. Sheet Metal Subcontractor:
  - 1. Installation of duct-mounted control devices.
  - 2. Access doors where indicated and as required for proper servicing.
- H. HVAC Contractor:
  - 1. Installation of immersion wells and sockets, along with associated shut-off cocks.
  - 2. Installation of pipe-mounted control devices.
- I. Testing and Balancing Contractor:
  - 1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
  - 2. The contractor shall provide training in the use of these tools.
  - 3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
  - 4. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.
- J. Electrical Subcontractor: Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the electrical drawings shall be included in Division 23. Electrical work shall, in general, comply with the following, unless otherwise directed by Division 26:
  - 1. Power wiring.
  - 2. All control wiring shown on electric plans such as unit heater line-voltage room thermostats.
  - 3. Duct smoke detectors required for air handler shutdown are supplied under Division 26. Coordinate required length of sampling tube, for full span of ductwork. The contractor shall connect the DDC system to the auxiliary contacts provided on the smoke detector for system safeties and to provide alarms to the DDC system.
  - 4. All electrical work shall comply with the N.E.C. and local electrical codes.
  - 5. All safety devices shall be wired through both hand and auto positions of motor starting device to insure 100% safety shut-off.
  - 6. Provide auxiliary contacts as required for interlock by BAS Contractor; the supplier shall estimate an allowance of at least one auxiliary contract per starter.

- K. Coordinate with controls specified in other sections of divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the BAS contractor as follows:
  - 1. All communication media and equipment shall be provided as specified hereinafter.
  - 2. Each supplier of a control product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.
  - 3. The BAS contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.
  - 4. The BAS contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
  - 5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

#### 1.7 WARRANTY

- A. Refer to Division 1 Requirements.
- B. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the engineer, the engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty. All work shall have a single warranty date, even when the owner has received beneficial use due to an early system start-up.
- C. All components, system software, and parts supplied by the BAS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BAS contractor at no charge shall furnish Labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 hours during normal business hours.
- D. Provide remote service diagnostic monitoring from the nearest service location. At the request of the owner, a service diagnostic call will be made to troubleshoot and resolve (if possible) any reported system complaints. The owner will provide a dedicated telephone line for connection to the system.

E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above-mentioned items also can be provided during the warranty period for an additional charge to the owner by purchasing an in-warranty service agreement from the contractor. Written authorization by the owner must, however, be granted prior to the installation of any of the above-mentioned items.

# PART 2 - PRODUCTS

#### 2.1 BUILDING AUTOMATION SYSTEM

- A. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules.
- B. Provide new wiring and network devices as required to provide a complete and workable control network.
- C. DDC system shall be Web based or Web compatible.
  - 1. Web-Based Access to DDC System:
    - a. DDC system software shall be based on server thin-client architecture, designed around open standards of Web technology. DDC system server shall be accessed using a Web browser over DDC system network, using Owner's LAN, and remotely over Internet through Owner's LAN.
    - b. Intent of thin-client architecture is to provide operators complete access to DDC system via a Web browser. No special software other than a Web browser shall be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
    - c. Web access shall be password protected.
  - 2. Web-Compatible Access to DDC System:
    - a. Operator workstation shall perform overall system supervision and configuration, graphical user interface, management report generation, and alarm annunciation.
    - b. DDC system shall support Web browser access to building data. Operator using a standard Web browser shall be able to access control graphics and change adjustable set points.
    - c. Web access shall be password protected.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated. System Performance Objectives:
  - 1. DDC system shall manage HVAC systems.
  - 2. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
  - 3. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
  - 4. DDC system shall operate while unattended by an operator and through operator interaction.
  - 5. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.
- B. DDC System Data Storage:
  - 1. Include server(s) with disk drive data storage to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
  - 2. When logged onto a server, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
  - 3. Server(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
  - 4. Server(s) shall use IT industry-standard database platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE).
- C. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
  - 1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
  - 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
  - 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
  - 4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
  - 5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
  - 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
  - 7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
  - 8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.

- 9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
- 10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed below.
- 11. Measured Variable and Reported Accuracy
  - a. Space Temperature;  $\pm 0.5^{\circ}C (\pm 1^{\circ}F)$
  - b. Ducted Air:  $\pm 0.5^{\circ}C (\pm 1^{\circ}F)$
  - c. Outside Air:  $\pm 1.0^{\circ}$ C ( $\pm 2^{\circ}$ F)
  - d. Dew Point:  $\pm 1.5^{\circ}C (\pm 3^{\circ}F)$
  - e. Water Temperature:  $\pm 0.5^{\circ}C (\pm 1^{\circ}F)$
  - f. Delta-T:  $\pm 0.15^{\circ}$  ( $\pm 0.25^{\circ}$ F)
  - g. Relative Humidity: ±5% RH
  - h. Water Flow:  $\pm 2\%$  of full scale
  - i. Airflow (terminal):  $\pm 10\%$  of full scale; Accuracy applies to 10%-100% of scale.
  - j. Airflow (measuring stations):  $\pm 5\%$  of full scale.
  - k. Airflow (pressurized spaces):  $\pm 3\%$  of full scale
  - 1. Air Pressure (ducts):  $\pm 25$  Pa ( $\pm 0.1$  in. w.g.)
  - m. Air Pressure (space):  $\pm 3$  Pa ( $\pm 0.01$  in. w.g.)
  - n. Water Pressure:  $\pm 2\%$  of full scale
  - o. Electrical: ±1% of reading, Not including utility-supplied meters
  - p. Carbon Monoxide (CO): ±5% of reading
  - q. Carbon Dioxide (CO2): ±50 ppm
- 12. Control Stability and Accuracy
  - a. Air Pressure:  $\pm 50$  Pa ( $\pm 0.2$  in. w.g.); Range of Medium: 0-1.5 kPa (0-6 in. w.g.)
  - b. Air Pressure: ±3 Pa (±0.01 in. w.g.); Range of Medium: 25 to 25 Pa (-0.1 to 0.1 in. w.g.)
  - c. Airflow:  $\pm 10\%$  of full scale
  - d. Space Temperature:  $\pm 1.0^{\circ}C (\pm 2.0^{\circ}F)$
  - e. Duct Temperature:  $\pm 1.5^{\circ}C (\pm 3^{\circ}F)$
  - f. Humidity: ±5% RH
  - g. Fluid Pressure: ±10 kPa (±1.5 psi); Range of Medium: 1–150 psi
- D. Environmental Conditions for Controllers, Gateways, Routers, Instruments and Actuators: Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application. Products shall be protected with NEMA enclosures suitable for the location where installed.
- E. Continuity of Operation after Electric Power Interruption: Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

#### 2.3 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. Provide new wiring and network devices as required to provide a complete and workable control network.
- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
- E. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
- F. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 23 09 93. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- G. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.
- H. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

#### 2.4 DDC EQUIPMENT

- A. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS), or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.
- B. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information.
- C. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using

ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

- D. Operator Workstation:
  - 1. Workstation or web server. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The following hardware requirements also apply:
    - a. The hard disk shall have sufficient memory to store:
      - 1) All required operator workstation software.
      - 2) A DDC database at least twice the size of the delivered system database.
      - 3) One year of trend data based on the points specified to be trended at their specified trend intervals.

Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.

- 2. Minimum hardware configuration shall include the following:
  - a. Motherboard: With 8 integrated USB 2.0 ports, integrated PCIE 10/100/1000 network adapter
  - b. Processor: Intel® Core<sup>TM</sup> i7
  - c. Hard drive shall be solid state type. The hard disk shall have sufficient memory to store: All required operator workstation software. A DDC database at least twice the size of the delivered system database. Three years of trend data based on the points specified to be trended at their specified trend intervals. Minimum size: 500GB.
  - d. Random-Access Memory: 16 GB minimum.
  - e. 90% Efficient Power Supply, Energy Star 5.0 compliant
  - f. Graphics: card as recommended by BAS supplier for optimum performance.
  - g. Monitor: 23.8-inch (minimum) High-Definition LED Display (1920 x 1080 at 75 Hz) with anti-glare.
  - h. Keyboard: QWERTY, 105 keys in ergonomic shape.
  - i. 16x DVD-RW drive
  - j. Mouse: Three button, optical.
  - k. APC BR1000G Back-UPS Pro 1000 VA 120V Power-Saving UPS System
  - 1. Operating System: Latest Windows with high-speed Internet access.
  - m. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.
  - n. Serial, parallel, and network communication ports and cables as required for proper DDC system operation.
- 3. Application Software:
  - a. I/O capability from operator station.
  - b. System security for each operator via software password and access levels.

- c. Automatic system diagnostics; monitor system and report failures.
- d. Database creation and support.
- e. Automatic and manual database save and restore.
- f. Dynamic color graphic displays with up to 10 screen displays at once.
- g. Custom graphics generation and graphics library of HVAC equipment and symbols.
- h. Alarm processing, messages, and reactions.
- i. Trend logs retrievable in spreadsheets and database programs.
- j. Alarm and event processing.
- k. Object and property status and control.
- 1. Automatic restart of field equipment on restoration of power.
- m. Data collection, reports, and logs. Include standard reports for the following:
  - 1) Current values of all objects.
  - 2) Current alarm summary.
  - 3) Disabled objects.
  - 4) Alarm lockout objects.
  - 5) Logs.
- n. Custom report development.
- o. Utility and weather reports.
- p. Workstation application editors for controllers and schedules.
- q. Maintenance management.
- 4. Custom Application Software:
  - a. English language oriented.
  - b. Full-screen character editor/programming environment.
  - c. Allow development of independently executing program modules with debugging/simulation capability.
  - d. Support conditional statements.
  - e. Support floating-point arithmetic with mathematic functions.
  - f. Contains predefined time variables.
- E. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
  - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

- 3. Standard Application Programs:
  - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short-cycling, PID control, DDC with fine tuning, and trend logging.
  - b. HVAC Control Programs
  - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
  - d. Remote communications.
  - e. Maintenance management.
- 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
- 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- F. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
  - 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include given communications; discrete/digital, analog, and pulse I/O; and monitoring, controlling, or addressing data points.
  - 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  - 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
  - 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- G. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
  - 1. Binary Inputs: Allow monitoring of on-off signals without external power.
  - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  - 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  - 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
  - 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
  - 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  - 7. Universal I/Os: Provide software selectable binary or analog outputs.

- H. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
  - 1. Output ripple of 5.0 mV maximum peak to peak.
  - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- I. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
  - 1. Minimum dielectric strength of 1000 V.
  - 2. Maximum response time of 10 nanoseconds.
  - 3. Minimum transverse-mode noise attenuation of 65 dB.
  - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

#### 2.5 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
  - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics, monitor system and report failures.
  - 3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
  - 4. Enclosure: Dustproof rated for operation at extreme ambient temperatures.

#### 2.6 SENSING DEVICES

- A. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.
- B. Thermistors: Precision thermistors may be used in applications below 200°F. Sensor accuracy over the application range shall be 0.36°F or less between 32 to 150°F. Stability error of the thermistor over five years shall not exceed 0.25°F cumulative. A/D conversion resolution error shall be kept to 0.1°F. Total error for a thermistor circuit shall not exceed 0.5 °F.

- C. Resistance Temperature Detectors (RTDs): Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32°F. Temperature sensor stability error over five years shall not exceed 0.25°F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25°F. The total error for a RTD circuit shall not exceed 0.5°F.
- D. Per ASHRAE 90.1-2016: Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies:
  - 1. Dry-bulb and wet-bulb temperatures shall be accurate to  $\pm 2^{\circ}$ F over the range of 40°F to 80°F.
  - 2. Enthalpy and the value of a differential enthalpy sensor shall be accurate to  $\pm 3$  Btu/lb. over the range of 20 to 36 Btu/lb.
  - 3. Relative humidity shall be accurate to  $\pm 5\%$  over the range of 20% to 80% RH.
- E. Temperature Sensor Details
  - 1. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor.
    - a. Provide room temperature sensors with:
      - 1) Timed override button
      - 2) Setpoint adjustment lever or knob.
      - 3) Override switch.
      - 4) Digital temperature display.
      - 5) Insulating Bases: For temperature sensors/thermostats located on exterior walls.
    - b. Provide a communication port or 802.11x wireless support for a portable operator interface like a notebook computer or PDA.
  - 2. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
  - 3. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 ft.
  - 4. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
  - 5. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.
- F. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

- G. Transmitters: Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 °F a year.
- H. Relative Humidity Transmitters: Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90% scale, and less than one percent drift per year. Sensing elements shall be the polymer type. Vaisala Model HMD50U or equal.
- I. Current Transducers: Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.
- J. Shielded Space Static Pressure Sensor: The shielded space static pressure sensors shall be the S.A.P./S shielded static air probes as manufactured by Air Monitor Corporation. Shielded static pressure sensor shall be suitable for surface recessed flush mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, all contained in an aluminum casing, with brushed finish on exposed surfaces. Probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 FPM from a radial source.
- K. Shielded Outside Air Static Pressure Sensor: The static outside air probe shall be the S.O.A.P. as manufactured by Air Monitor Corporation or approved equal. Outdoor static pressure sensor shall be constructed of 10-gauge Type 316 stainless steel with a 2" diameter FPT connection. The outdoor air probe shall be capable of sensing the outside atmospheric air pressure to within 2% of the actual value when subjected to radial wind velocities up to 40 miles per hour with approach angles up to 30° to the horizontal.
- L. Input Switches
  - 1. Timed Local Overrides: Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24-hour continuous operation.
  - 2. Freeze Protection Thermostats: Provide special purpose thermostats with flexible capillary elements 20-feet minimum length for coil face areas up to 40-SF. Provide longer elements for larger coils at 1-foot of element for every 4-SF of coil face area or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.
- M. Airflow Measuring Stations:
  - 1. General

- a. Provide one thermal airflow measuring device (AMD) for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
- b. Each AMD shall use the principal of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
- c. Each AMD shall be provided with one or more sensor probes having one or more sensor nodes per probe.
- d. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs, or similar "hot wire" devices are not acceptable.
- e. Thermistors shall be potted in an engineering thermoplastic assembly using waterproof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.
- f. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
- g. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
- h. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.
- i. The airflow sensing thermistor of each sensor node shall be self-heated. Devices using Indirectly heated thermistors are not acceptable.
- j. Each sensor node shall be independently processed by the transmitter prior to averaging and output.
- k. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.
- 1. Installed accuracy shall include the uncertainty of the AMD and the additional uncertainty that results from the placement of the AMD in the airstream. The specified installed accuracy is based on the AMD being installed in accordance with manufacturers published placement and installation guidelines.
- m. Transmitters shall be microprocessor-based and operate automatically after brownouts and/or transient power interruptions.
- n. All printed circuit boards shall have gold plated interconnects, edge fingers, and test points.
- o. Remote transmitters shall have an LCD and four-button user interface.
- p. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120°F and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.
- q. Probes with remote transmitters shall be "plug and play", not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable

and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.

- r. All components of each AMD shall be RoHS2 compliant.
- s. Each AMD shall be UL/cUL listed as a final assembly.
- t. Each AMD shall be FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.
- u. European shipments shall be CE marked. Compliance shall be demonstrated by an independent test laboratory.
- v. Devices with a BACnet network connection shall be BTL tested and listed.
- 2. Basis of Design:
  - a. Duct and plenum AMD with temperature measurement and remote transmitter: EBTRON models GTx116-P+ and GTx116e-P+.
  - b. Duct and plenum AMD with temperature and humidity measurement and remote transmitter: EBTRON model GTx116e-P+/H
  - c. Small duct and air terminal AMD with temperature measurement and remote transmitter: EBTRON model EF-x2000-T.
  - d. Small duct and air terminal AMD with temperature measurement and integral transmitter: EBTRON model EF-x1000-T.
  - e. Fan airflow and temperature measurement with remote transmitter: EBTRON models GTx108-F
- N. Pressure Transmitters/Transducers:
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
    - g. Kele
  - 2. Duct Differential Pressure Transmitters: Kele M30/40 and T30/40 Series, or approved equal; reliable, stable, low-air pressure transmitters with 4-20 mA outputs.
  - 3. Duct pressure high-limit: Kele Model 1900-5-MR manual reset pressure switch is designed to monitor duct static and shut down the blower when excess pressure occurs. The switch must be manually reset before the system can start again. Switch contacts are SPDT with solder-type connections. The Model 1900-5-MR measures static pressure only, not differential pressure.
  - 4. Air Differential Pressure Switches, Kele 1900 Series, are designed to monitor the differential pressure of air in HVAC applications. These automatic reset switches are available in ranges from 0.07" to 20" W.C. and shall have SPDT screw-type electrical connections.
  - 5. Filter pressure drop: Kele Model A-602 air filter kit includes two static pressure tips and aluminum tubing and fittings, and it allows the Kele 1900 Series to monitor filter pressure drop.

- 6. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated. Accuracy: 2 percent of full scale with repeatability of 0.5 percent. Output: 4 to 20 mA. Building Static-Pressure Range: 0- to 0.25-inch wg. Duct Static-Pressure Range: 0- to 5-inch wg.
- 7. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
- 8. Hydronic Differential Pressure Transmitters: Bell & Gossett ST Series; Setra or approved equal. Transmitter shall provide an isolated linear 4-20 mA dc output. The unit shall be accurate to ± 0.07% of full span and shall withstand over ranges up to a static pressure of 2300 psi with negligible change in output. It shall have stainless steel wetted parts with 1/4" NPT process connection. Unit shall be protected against radio frequency interference and shall have a watertight (NEMA Type 6/6P) electrical enclosure with ½" NPT conduit connection.

# 2.7 GAS DETECTION

- A. Boiler Room Gas Detection Device type AGS Mini Merlin CH4CO:
  - 1. The device will be 120 Vac powered, individually powered and capable of accepting the inputs of multiple devices. The unit will clearly display the condition of an alarm and provide hazardous or toxic gas levels via ppm or % of VOL. The device shall provide a re-set and test function. The device shall incorporate dual sensor technology to detect Methane and CO (Carbon Monoxide) without the requirement for additional components. The unit shall be UL certified and listed. Mount the panel per manufacturer's instructions and recommendations.
  - 2. The device panel will be capable of transmitting alarm conditions to a BMS system through its dry contact relay output. For local activation of fans or louvers (or other equipment), the relay will change state in alarm and revert back once the alarm has been removed.
  - 3. The device panel will be capable of operating within relative humidity ranges of 5-95% noncondensing and temperature ranges of -4° F to 140° F.
  - 4. The device will be certified and listed to ANSI/UL 61010-1 3<sup>rd</sup> edition and CAN/CSA-C22.2 No. 61010-1.
  - 5. For local activation of audible alarms, the transmitter shall have an on-board device able to generate an audible output of 85 dBA @ 10 ft.
  - 6. The unit shall provide a traffic signal type colored TFT display, Green all clear, Yellow warning (low alarm) Red Alarm.
  - 7. Detector alarm levels are to be activated and the unit is to be installed in accordance with the following parameters:

CASES	TDLR Code Required Limits			MOUNTING	COVERAGE
GASES				REIGHT	KADIUS
Carbon Monoxide	35ppm	50ppm		Per	50 ft
(CO)				Manufacturer's	
				Instructions	
	1st ALARM	2nd ALARM	3rd ALARM	MOUNTING	COVERAGE
	SET POINT	SET POINT	SET POINT	HEIGHT	RADIUS
Methane	8% of LEL	10% of LEL		Per	50 ft
	4% of VOL	5% of VOL		Manufacturer's	
				Instructions	

- 8. The sensors shall be UL listed to comply with UL2075 and incorporate filters to only look for the desired hazardous or toxic gases selected.
- 9. Local Building Codes recommendations take precedence over these parameters. Coverage can differ depending on application.
- 10. Sequence of Operation
  - a. If Methane Sensor detects 8% of LEL, the detector shall indicate Low Alarm level via TFT screen. If the hazardous gas level reaches 10% of LEL the detector shall indicate High Alarm level via TFT screen and audible alarm. The internal relay outputs shall change state communicating the alarm condition to the BAS and fire alarm control panel.
  - b. If CO sensor detects Carbon Monoxide the detector shall indicate Low Alarm level via TFT screen. If CO levels continue to rise or trigger alarm thresholds as per the OSHA Dept of Labor TWA alarm thresholds the detector shall indicate High Alarm via TFT screen and audible alarm. The internal relay outputs shall change state communicating the alarm condition to the BAS and fire alarm control panel.
- B. Carbon-Dioxide (CO2) Sensor:
  - 1. Manufacturers: Vaisala GMW21 and GMD20 Series, Honeywell Model C7232, MSA Airox Model 711271, GE-Telaire.
  - 2. Analog and a relay output, use non-dispersive infrared (NDIR) technology, and feature a unique corrosion-free sensing chamber for accurate, stable CO2 sensing.
  - 3. Gold-plated sensor for long-term calibration stability
  - 4. Automatic Background Calibration (ABC) algorithm based on long-term evaluation to reduce required maintenance. <u>Manufacturer recommended calibration interval shall not be less than five years</u>.
  - 5. Configuration as indicated: Wall mount with LCD to provide sensor readings and status information or Duct mount.

# 2.8 OUTPUT HARDWARE

- A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:
  - 1. Submittals shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Dampers shall meet the leakage requirements of the International Energy Conservation Code by leaking less than 3 cfm/sq. ft. at 1" of static pressure and shall be AMCA licensed as Class 1A. Dampers shall be Ruskin model CD60 or approved equal.
  - 2. Control dampers shall be the parallel or opposed blade type as follows: Outdoor and/or return air mixing dampers shall be parallel blade, arranged to direct airstreams toward each other. Other modulating dampers shall be the opposed blade type. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
  - 3. Frame: 5" x minimum 16 gage roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13-gage U-channel. Damper blades shall not exceed 8" in width or 48" in length. Blades shall be suitable for medium velocity performance 2000 fpm. Blades shall be not less than 16-gauge.
  - 4. Bearings shall be corrosion resistant, permanently lubricated stainless steel sleeve type turning in an extruded hole in the damper frame.

- 5. All blade edges, top, and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel.
- 6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- 7. Modulating dampers shall provide a linear flow characteristic where possible.
- 8. Dampers shall have exposed linkages. Dampers over 48" in applications where sectioning is not applicable shall be supplied with a jackshaft to provide sufficient force throughout the intended operating range.
- B. Electronic damper/valve actuation shall be provided.
  - 1. Manufactured, brand labeled or distributed by BELIMO, or approved equal.
  - 2. Size for torque required for damper seal at load conditions.
  - 3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
  - 4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
  - 5. Overload protected electronically throughout rotation.
  - 6. Fail-Safe Operation: Mechanical, spring-return mechanism.
  - 7. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.
  - 8. Proportional Actuators shall be fully programmable through an EEPROM without the use of actuator mounted switches.
  - 9. Proportional actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
  - 10. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.
  - 11. Temperature Rating: -22 to +122°F.
  - 12. Housing: Minimum requirement NEMA type 2 mounted in any orientation.
  - 13. Agency Listings: ISO 9001, cULus, CE or CSA
  - 14. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
- C. Control Valves: Control valves shall be two-way or three-way type for two-position or modulating service as shown.
  - 1. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
    - a. Two-way: 150% of total system (pump) head.
    - b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
  - 2. Water Valves: Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.

- a. Sizing Criteria:
  - 1) Two-position service: Line size.
  - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, which ever is greater.
  - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load); 5 psi maximum.
- b. Application:
  - 1) VAV-reheat coils: two-way floating control, non spring return.
  - 2) CUH and Convectors: two-way two position, spring open 100%.
  - 3) AHU main heating coils: two-way modulating control, spring open 100%.
  - 4) Fintube radiation: zone valves. Zone valves shall have brass bodies with female NPT or sweat ends and a stainless-steel stem. Normally open zone valve actuators shall on/off and shall be available in 24VAC or 120VAC. Zone valves shall have push button for quick removal of actuator. Zone valves shall have a leakage rate of 0.1% or lower.
- c. Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, springloaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless-steel ball.
- d. Valves 2<sup>1</sup>/<sub>2</sub> in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
- e. Water valves shall fail normally open or closed, as specified.
- D. Output Switches: Control Relays; Field installed and DDC panel relays shall be double pole, double throw, UL864 listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

# 2.9 STATUS SENSORS

- A. VFD Motor Current Switches: Veris Hawkeye H614, or equal; microprocessor based, self-learning, self-calibrating current-sensitive switching device designed for use with VFD systems. At initial power-up, the H614 automatically learns the average current on the line with no action required by the installer. Once a current is learned, the switch monitors for changes in current greater than +/-20% of the learned load. When calibrated for a given VFD system, the H614 is tolerant of gradual drifts in frequency due to expected conditions, such as an accumulation of debris in a filter, while still detecting a sudden drop due to a potential abnormal system condition (e.g., belt loss or other mechanical failure).
  - 1. Microcontroller based learning technology automatically learns load upon initial power-up minimizes calibration labor.
  - 2. Automatic trip point automatic trip point (1.5 to 150 A, 12 to 115 Hz) detects abnormal events.

- 3. Under and over-load microcontroller based learning technology automatically learns load.
- 4. Saves space small size fits easily inside small starter enclosures.
- 5. 100% solid-state no. moving parts to fail.
- 6. LED status
- 7. Induced from monitored conductor sensor power.
- B. ECM Motor Current Switch: Veris H6ECM, or equal: current-sensitive switching device that monitors current (amperage) in the conductor passing through it. A change in amperage in the monitored conductor that crosses the switch (setpoint) causes the resistance of the FET status output to change state, similar to the action of a mechanical switch. The status output is suitable for connection to building controllers or other appropriate data acquisition equipment operating at up to 30 V. The product requires no external power supply to generate its output. The ECM is a brushless DC motor that is supplied AC power, converts that power to DC current and uses electronic switching to control the motor rotation. The ECM motor shaft speed can be reduced to save energy, resulting in lower cost and less component wear. The H6ECM is optimized to provide meaningful proof of rotation which verifies that the ECM motor is operating as expected.
  - 1. High performance device, split-core housing.
  - 2. Precise current trip point setting.
  - 3. Small size fits easily inside small enclosures.
  - 4. Self-gripping iris for easy installation.
  - 5. Status LEDs for easy setup and local indication.
  - 6. Up to 1 A status output increased application flexibility.
  - 7. Induced from monitored conductor sensor power.
- C. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- D. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainlesssteel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

#### 2.10 ELECTRICAL POWER AND DISTRIBUTION

- A. Transformers: Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.
- B. Surge and Transient Protection
  - 1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
  - 2. Power Line Surge Protection: Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
- b. The device shall react within 5 nanoseconds and automatically reset.
- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
- k. The device shall be capable of operating between -20 °F and 122 °F.
- 3. Telephone and Communication Line Surge Protection: Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology. The device shall be installed at the distance recommended by its manufacturer.
- 4. Controller Input/Output Protection: Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.
- C. Wiring: Provide complete electrical wiring for the DDC System, coordinate line of demarcation with Division 26. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Division 26. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, attics, or above suspended ceilings.
- D. Power Wiring: The following requirements are for field-installed wiring:
  - 1. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
  - 2. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

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E. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

#### PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be provided at the expense of this contractor.

# 3.2 INSTALLATION

- A. Provide software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation. Connect and configure equipment and software to achieve sequence of operation specified.
- B. Provide all components in accordance with the manufacturer's recommendations. Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.
- C. Provide equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- D. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.

- F. Temperature Sensors: Provide temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.
- G. Room Temperature Sensors: Verify location of thermostats and other exposed control sensors with plans and room details before installation. Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 48" above the floor to meet ADA requirements.
- H. Duct Temperature Sensors
  - 1. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration airtight. Seal the duct insulation penetration vapor tight.
  - 2. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit; maximum 18" x 18". For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.
- I. Outside Air Temperature Sensors: Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.
- J. Gas Monitor/Transmitters: Verify location of transmitter with room layout and details before installation. Do not exceed the manufactures' recommended maximum surveillance radius. Provide proper quantity as required. Mounting height shall be at manufacturer recommended height for the gas being sensed.
- K. Meters: Locate meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.
- L. Provide automatic dampers according to Section 233113 "Ductwork."
- M. Provide damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- N. Provide labels and nameplates to identify control components according to Section 23 05 00 "Common Work Results".
- O. Provide hydronic instrument wells, valves, and other accessories according to Section 23 21 13 "Hydronic HVAC Piping". Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid

restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

P. Provide duct volume-control dampers according to Section 23 31 13 "Ductwork"

#### 3.3 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of Division 26 shall take precedence.
- B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements. Low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.
- C. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.
- D. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- E. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 ft intervals.
- F. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- G. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- H. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- I. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- J. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- K. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- L. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.

- M. Include one pull string in each raceway in 1-inch or larger.
- N. Use color-coded conductors throughout with conductors of different colors.
- O. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- P. Conceal all raceways except within mechanical, electrical, or service rooms.
- Q. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- R. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
- S. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
- T. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- U. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3-feet in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.
- V. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes. Ends not terminating in boxes shall have bushings installed.

#### 3.4 COMMUNICATION WIRING

- A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- C. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.
- E. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer's instructions.

- F. All runs of communication wiring shall be unspliced length when that length is commercially available.
- G. All communication wiring shall be labeled to indicate origination and destination data.
- H. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- I. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135.
- J. Fiber Optic Cable: Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

# 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
- B. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
  - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 6. Check temperature instruments and material and length of sensing elements.
  - 7. Check control valves. Verify that they are in correct direction.
  - 8. Check DDC system as follows:

- a. Verify that DDC controller power supply is from emergency power supply, if applicable.
- b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
- c. Verify that spare I/O capacity has been provided.
- d. Verify that DDC controllers are protected from power supply surges.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

# 3.6 ADJUSTING

- A. Calibrating and Adjusting:
  - 1. Calibrate instruments.
  - 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
  - 3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
  - 4. Control System Inputs and Outputs:
    - a. Check analog inputs at 0, 50, and 100 percent of span.
    - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    - c. Check digital inputs using jumper wire.
    - d. Check digital outputs using ohmmeter to test for contact making or breaking.
    - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
  - 5. Flow:
    - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    - b. Manually operate flow switches to verify that they make or break contact.
  - 6. Pressure:
    - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
  - 7. Temperature:
    - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    - b. Calibrate temperature switches to make or break contacts.
  - 8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.

- 9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
- 10. Provide diagnostic and test instruments for calibration and adjustment of system.
- 11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature and humidity set points.
- C. 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 three visits to Project during other than normal occupancy hours for this purpose.

# 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 017900 "Demonstration and Training."
- B. Provide a qualified instructor (or instructors) with five years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Owner. Training shall take place at the job site.
- C. This training shall last a minimum of four (4) hours and shall be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. Upon completion of the Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:
- D. Provide basic control system fundamentals training.
  - 1. This project's list of control system components
  - 2. This project's list of points and objects
  - 3. This project's device and network communication architecture
  - 4. This project's sequences of control, and:
  - 5. Alarm capabilities
  - 6. Trending capabilities
  - 7. Troubleshooting communication errors
  - 8. Troubleshooting hardware errors
- E. Provide additional project-specific training:
  - 1. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
  - 2. A discussion of the components and functions at each DDC panel
  - 3. Logging-in and navigating at each operator interface type.
  - 4. Using each operator interface to find, read, and write to specific controllers and objects.
  - 5. Modifying and downloading control program changes

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- 6. Modifying setpoints
- 7. Creating, editing, and viewing trends
- 8. Creating, editing, and viewing alarms
- 9. Creating, editing, and viewing operating schedules and schedule objects
- 10. Backing-up and restoring programming and data bases
- 11. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics
- 12. Creating new graphics and adding new dynamic data displays and links.
- 13. Alarm and Event management
- 14. Adding and removing network devices

# 3.8 TEST AND BALANCE SUPPORT

- A. The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel This support shall include:
  - 1. On-site operation and manipulation of control systems during the testing and balancing.
  - 2. Control setpoint adjustments for balancing all relevant mechanical systems.
  - 3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

#### 3.9 CONTROLS SYSTEM OPERATOR'S MANUALS

- A. Provide three electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.
- B. Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable.
- C. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:
  - 1. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.
  - 2. A copy of the project's mechanical design drawings, including any official modifications and revisions.
  - 3. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."
  - 4. A copy of the project's approved Performance Verification Testing Plan and Report.
  - 5. A copy of the project's approved final TAB Report.
  - 6. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
  - 7. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.

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- 8. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
- 9. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
- 10. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
- 11. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Owner for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

# 3.10 CLEANING

- A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be required to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 23 Section Common Work Results
  - 2. Section 230900 Direct Digital Control (DDC) System
  - 3. Other Sections Equipment with built in DDC controllers.
  - 4. Division 23 Section Testing, Adjusting, and Balancing
  - 5. Division 26
  - 6. Division 28

# 1.2 GENERAL

- A. Control sequences are intended to be performance based. Implementations that provide the same functional result using different underlying detailed logic will be acceptable. As noted, control sequences shall be in accordance with ASHRAE Guideline 36-2021.
- B. All points shown in the points list or described in the sequence shall be shown on the graphics.
- C. All setpoints including setpoints internal to control algorithms shall be adjustable from all BAS operator interfaces. All commands shall be overridable from all BAS operator interfaces. All control points shall be adjustable or overridable from the same graphic page that displays the points.
- D. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all of the points' associated values, shall be connected to the BAS and available to the BAS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.
- E. Unless otherwise indicated, control loops shall be enabled and disabled based on the status of the system being controlled to prevent windup.
- F. When a control loop is enabled or reenabled, it and all its constituents (such as the proportional and integral terms) shall be set initially to a neutral value.
- G. A control loop in neutral shall correspond to a condition that applies the minimum control effect, i.e., valves/dampers closed, VFDs at minimum speed, etc.

- H. When there are multiple OA temperature sensors, the system shall use the valid sensor that most accurately represents the OA conditions at the equipment being controlled.
- I. The term "control loop" or "loop" is used generically for all control loops. These will typically be PID loops, but proportional plus integral plus derivative gains are not required on all loops. Unless specifically indicated otherwise, the guidelines in the following subsections shall be followed.
  - 1. Use proportional only (P-only) loops for limiting loops (such as zone CO2 control loops, etc.). Limiting loops are used to prevent controlled variables from rising above or dropping below setpoint (depending on the application) by defining a fixed threshold at which the loop output reaches 100%. Limiting loops shall use proportional-only control to prevent integral windup from causing the controlled sensor to overshoot setpoint due to the sensor generally being far from setpoint.
  - 2. Do not use the derivative term on any loops unless field tuning is not possible without it. Use of the derivative term makes loop tuning difficult in practice. It can make loops unstable because it increases as the rate of change of the error increases, amplifying the error signal. It is used in industrial process controls and systems that have to react quickly but is rarely if ever needed in HVAC system.
- J. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, humidity, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable.
- K. To avoid abrupt changes in equipment operation, the output of every control loop shall be capable of being limited by a user adjustable maximum rate of change, with a default of 25% per minute.
- L. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- M. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Safeties shall override runtime timers.
- N. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- O. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user with appropriate access level (e.g., for testing and commissioning). If hardware design prevents this for hardware points, they shall be equated to a software point, and the software point shall be used in all sequences. Exceptions shall be made for machine or life safety.

- 1. All hardware points, not just inputs, shall be capable of being overridden for purposes of testing and commissioning. For example, the commissioning agent shall be able to command damper positions, valve positions, fan speeds, etc. directly through BAS overrides.
- 2. The requirement to equate hardware points to software points is necessary for systems that do not allow overriding real input points.
- 3. The user interface shall allow the user to set an expiration period that automatically releases the override after the period has expired. The system shall also keep track of who initiates each override and when.
- P. Provide Sequenced starting of HVAC equipment at initial startup, whether or not specifically mentioned in each Sequence of Operation.
- Q. All setpoints indicated in the control specification are to be adjustable. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on the requirements of the building. The control contractor shall work with the TAB contractor (230593) and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use.
- R. BACnet
  - 1. All controllers with BACnet cards shall be integrated into the DDC system via BACnet. Provide DDC programming to define input and output information available through the boiler manufacturer's integration data port.
  - 2. All hardwired points and any setpoints, timers, or other control elements that are specified to be adjustable (adj.) shall be mapped as BACnet objects and be available on the user interface to be adjusted.
- S. Trends shall be provided for all hardware I/O points and integrated points listed as having trending and for analog and binary data points mapped to the user interface. Interval trending with sample intervals of 10 minutes shall be provided on analog process variables (this includes both analog inputs and calculated process variables) and process outputs. Data shall be stored at the supervisory controller or in the field controller and uploaded to the DDC system server when archiving is desired. Consult with the Owner to determine which trends should be archived. Trending shall be in place for a minimum of 24 hours prior to functional testing by the commissioning provider. The BAS shall sample and store trend data and shall be able to archive data to the hard disk.
- T. Variable Frequency Drives (VFD) Speed Points per ASHRAE Guideline 36-2021:
  - 1. The speed AO sent to VFDs shall be configured such that 0% speed corresponds to 0 Hz, and 100% speed corresponds to maximum speed configured in the VFD.
  - 2. For each piece of equipment, the minimum speed shall be stored in a single software point; in the case of a hard-wired VFD interface, the minimum speed shall be the lowest speed command sent to the drive by the BAS. The active minimum speed parameter shall be read every 60 minutes via the drive's network interface. When a mismatch between the drive's active minimum speed and the minimum speed stored in the software point is detected, the minimum speed stored in the software point shall be written to the VFD via

the network interface to restore the active minimum speed parameter to its default value and generate a Level 4 alarm.

- 3. Minimum speed setpoints for VFD-driven equipment shall be determined in accordance with the testing, adjusting, and balancing (TAB) specifications.
- U. Point Types
  - 1. AO = analog output
  - 2. DO = digital output (also, BO = binary output)
  - 3. AI = analog input
  - 4. DI = digital input (aka BI = Binary Input)

# 1.3 ALARMS

- A. Provide alarms per ASHRAE Guideline 36, Paragraph 5.1.12: "Alarms".
- B. Provide at least the following requirements in the specification for the BAS graphical user interface:
  - 1. All alarms shall include a time/date stamp using the standalone control module time and date.
  - 2. Each alarm can be configured in terms of level, latching (Requires Acknowledgment of a Return to
  - 3. Normal/Does Not Require Acknowledgment of a Return to Normal), entry delay, exit deadband, and post-suppression period.
  - 4. An operator shall be able to sort alarms based on level, time/date, and current status. Alarms should be reported with the following information:
    - a. Date and time of the alarm
    - b. Level of the alarm
    - c. Description of the alarm
    - d. Equipment tags for the units in alarm.
    - e. Possible causes of the alarm if provided by the fault detection routines.
    - f. The source that serves the equipment in alarm, per ASHRAE Guideline 36, Paragraph 5.1.19 "Hierarchical Alarm Suppression".
- C. As per ASHRAE Guideline 36, there shall be 4 levels of alarm:
  - 1. Level 1: Life-safety message
  - 2. Level 2: Critical equipment message
  - 3. Level 3: Urgent message
  - 4. Level 4: Normal message
- D. Alarms shall be reset during a power failure; the controls shall be programmed to ignore alarms that will occur upon loss of power. For example, a pump status alarm is not necessary, since it's obvious that the pump will fail upon loss of power.
- E. Alarms associated with equipment that is disabled shall be inhibited.
- F. Current status switches shall prove the operation of fans and pumps. Level 2 Alarm, Fans & pumps: Status point not matching it's on/off point for 3 seconds after a time delay of 15 seconds while the equipment is commanded on. The term "proven" (i.e., "prove ON"/ "prove OFF") shall mean that the equipment's DI status point (current switch) matches the state set by the equipment's DO command point.
- G. If an operating equipment has any fault condition, a Level 2 alarm shall be generated, and a response shall be triggered as defined in ASHRAE Guideline 36.

# 1.4 TRIM & RESPOND (T&R) SET-POINT RESET LOGIC

- A. Provide T&R logic per ASHRAE Guideline 36, Paragraph 5.1.14: "Trim & Respond Set-Point Reset Logic".
- B. Trim & Respond logic shall reset the setpoint within the range minimum (SPmin) to maximum (SPmax) setpoint. When the associated device is OFF, the setpoint shall be SP0.
- C. T&R logic resets a setpoint for pressure, temperature, or other variables. It reduces the setpoint at a fixed rate until a downstream zone is no longer satisfied and generates a request. When a sufficient number of requests are present, the setpoint is increased in response. The importance of each zone's requests can be adjusted to ensure that critical zones are always satisfied. When a sufficient number of requests no longer exist, the setpoint resumes decreasing at its fixed rate. A running total of the requests generated by each zone is kept identifying zones that are driving the reset logic.

# 1.5 EQUIPMENT STAGING AND ROTATION

- A. All parallel equipment shall be lead/lag or lead/standby rotated to maintain even wear.
- B. Provide per ASHRAE Guideline 36, Paragraph 5.1.15: "Equipment Staging and Rotation".
- C. Two runtime points shall be defined for each equipment:
  - 1. Lifetime Runtime: The cumulative runtime of the equipment since equipment start-up. This point shall not be readily resettable by operators. Lifetime Runtime shall be stored to a software point on the control system server, so the recorded value is not lost due to controller reset, loss of power, programming file update, etc.
  - 2. Staging Runtime: An operator resettable runtime point that stores cumulative runtime since the last operator reset. Staging Runtime provides a resettable runtime counter, which allows for reset of the staging runtime hours used for lead/lag or lead/standby rotation between maintenance intervals or equipment replacement while maintaining a separate log of the Lifetime Runtime.
- D. Lead/lag equipment: Unless otherwise noted, identical parallel staged equipment (e.g., pumps) shall be lead/lag alternated when more than one is off or more than one is on so that the equipment with the most operating hours as determined by Staging Runtime is made the last stage equipment and the one with the least number of hours is made the lead stage equipment.

- E. From the BAS operator interface, an operator shall be able to manually change the lead/standby sequence or request any pump to be unavailable which would remove it from the rotation sequence.
- F. A faulted equipment is any equipment commanded to run that is either not running or unable to perform its required duty. For fans& pumps, upon identification of a fault condition:
  - 1. The next commanded off equipment in the staging order, Equipment "B", shall be commanded on while alarming Equipment "A" remains commanded on.
  - 2. If Equipment "B" fails to prove status (i.e., it also goes into alarm), it shall remain commanded on and the preceding step shall be repeated until the quantity of equipment called for by the current stage has proven on, or there is no more available equipment.
  - 3. Set alarming equipment to the last positions in the lead/lag or lead/standby staging order sequenced reverse chronologically (i.e., the equipment that alarmed most recently is sent to last position).
  - 4. Staging order of non-alarming equipment shall follow the even wear logic. Equipment in alarm can only automatically move up on the staging order if another equipment goes into alarm.
  - 5. Equipment in alarm shall run if so called for by the lead/lag or lead/standby staging order and present stage.

# PART 2 - SEQUENCES

## 2.1 BASIS OF DESIGN

A. Design Setpoints.

Type of Area	Winter	Summer	
	DB	DB	
Office	70°F	75°F	
Corridor	70°F	78°F	
Courtrooms	70°F	75°F	
Other, if not listed	70°F	75°F	
Electrical Closets	55°F	78°F	
Mechanical Spaces	55°F	95°F	
Electrical Switchgear	55°F	95°F	
Emergency Generator Room	65°F	100°F	
Elevator Machine Room	55°F	100°F	
Stairwells	60°F	None	
Storage Rooms	60°F	85°F	
Vestibules	60°F	85°F	

B. Heating systems shall be equipped with controls configured to automatically restart and temporarily operate the system as required to maintain zone temperatures above an adjustable heating setpoint down to 55°F.

- C. Cooling systems shall be equipped with controls configured to automatically restart and temporarily operate the mechanical cooling system as required to maintain zone temperatures below an adjustable cooling setpoint up to 85°F or to prevent high space humidity levels.
- D. Outside Air (OA) Conditions
  - 1. The controller shall monitor the OA temperature and humidity and calculate the OA enthalpy on a continual basis. These values shall be made available to the system at all times.
  - 2. Level 3 alarm shall be generated for Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate OA conditions sensor shall be made available to the system without interruption in sensor readings.
  - 3. If an OA Temp Sensor cannot be read, a default value of 0°F shall be used.
  - 4. If an OA Humidity Sensor cannot be read, a default value of 50 % shall be used.

## 2.2 AUTOMATIC RESTART SEQUENCES / GENERATOR MODE

- A. Provide Sequenced starting of all equipment, whether or not specifically mentioned in each Sequence of Operation: At initial start-up; for automatic starting on emergency power after power blackout.
- B. The BAS contractor shall submit an automatic restart sequence of operation that prioritizes the loads to be restarted, in order of importance, when a changeover in power occurs, either from normal power to emergency power or from emergency power to normal power and when there is more than one (1) piece of mechanical equipment to start at the same time (e.g., at the beginning of a normally scheduled occupied cycle). The automatic restart sequence of operation shall also show the time delays between the startup of each piece of mechanical equipment.
- C. In addition, during emergency power mode, the BAS shall stagger HVAC loads to prevent the power demand from exceeding generator capacity.
  - 1. Comfort cooling shall be disabled.
  - 2. Heating setpoint shall reduce to 50°F. The intent is to cycle equipment throughout the building keep the building from freezing, see below.
  - 3. The equipment is categorized as shown below, see Points List on the drawings for more specific information.
    - a. Equipment ON during generator mode.
      - 1) AC-1 (supply fan and gas furnace only-Supply fan limited to 50% speed) New and existing return fans off.
      - 2) AC-2 (Supply and Return fans and gas furnace-limit fan speed to 50%)
      - 3) State side and county side boilers and heating pumps
      - 4) BAS front end
      - 5) IT Room heat pumps

- b. Equipment OFF during generator mode.
  - 1) Chiller and chilled water pumps
  - 2) AC-1 return fan
  - 3) Exhaust fans
  - 4) Cooling Towers
  - 5) VRF heat pumps shall provide heating only, setback temperatures
- D. Simultaneous starting of motors shall be prevented by a sequential start program in the DDC system. This program shall also provide sequential restart after power failure of motors that were running prior to power failure.
- E. Software time delay relays shall be provided in the DDC system to allow fan motors to cool down before restarting. Motors shall have both a minimum interval time (between consecutive starts) of 10 minutes and a minimum off time (between stop and start) of 3 minutes.
- F. Automatic restart of fans after a safety shutdown trip shall be software prohibited through the de-energization of the remote start/stop contact. Fan restart shall be manually initiated by the operator either locally or remotely through a computer workstation after resolving the cause for shutdown.
- G. Operator Workstation: Display the following data:
  - 1. Individual minimum interval time for each piece of mechanical equipment.
  - 2. Individual minimum off time for each piece of mechanical equipment.
  - 3. Individual motor horsepower or amps.
  - 4. Individual restart delay for each piece of mechanical equipment.

## 2.3 HEATING PLANT (STATE SIDE FACILITY)

- A. Provide integration to the existing Autoflame controller for monitoring of available points and issuing Start/Stop Command.
- B. Provide Setpoints per Guideline 36-2021 Paragraph 3.1.8. Hot Water Plant; also see equipment schedules.
  - 1. HW-LOT, the outdoor air lockout temperature above which the boiler plant is prevented from operating, 55°F OA (adj.). HW-LOT is a safety to prevent plant operation when it should not be needed.
- C. Guideline 36-2021 Paragraph 5.21.2. Plant Enable/Disable: The Boiler plant shall include an enabling schedule that allows operators to lock out the plant during off-hours, e.g., to allow off-hour operation of HVAC systems except the Boiler plant. The default schedule shall be 24/7 (adj.).
  - 1. Enable the plant in the lowest stage when the plant has been disabled for at least 15 minutes and:

- a. OAT<HW-LOT, and
- b. The Boiler plant enable schedule is active.
- 2. Disable the plant when it has been enabled for at least 15 minutes and:
  - a. OAT>HW-LOT +  $1^{\circ}$ F, or
  - b. The Boiler plant enable schedule is inactive.
- D. Each boiler shall run subject to its own internal safeties and controls as currently operating. Upon a call for heat, the boiler controller shall enable required devices and equipment (HW isolation valve, boiler pump).
- E. Level 3 Alarm: Low boiler leaving hot water temperature (more than 15°F below setpoint) for more than 15 minutes when boiler has been enabled for longer than 15 minutes.
- F. Hot Water Pumps are "Smart Pumps": Pumps shall run continuously whenever heating is requested from the system it is serving or when the system is enabled by the operator. BAS shall prove operation of the pump. The pump speed control is built into the self-sensing "smart" pumps specified in Section 232123. During operation, the pump automatically makes the necessary adjustment to the actual system characteristic.
  - 1. Parallel pumps shall be controlled per Paragraph 1.5 "Equipment Staging & Rotation".
  - 2. Provide communication wiring between the pumps.
- G. Guideline 36-2021 Paragraph 5.21.10. Alarms
  - 1. Boiler fault, Level 2.
  - 2. Low boiler leaving HW temperature (more than 15°F below setpoint) for more than 15 minutes when boiler has been enabled for longer than 15 minutes: Level 3.
  - 3. Provide pump fault alarms per Paragraph 1.3 "Alarms".

# 2.1 HEATING PLANT (COUNTY SIDE FACILITY)

A. Provide integration to the existing Autoflame DTI controller for monitoring of available points. Steam boilers shall continue to operate as they currently exist.

# 2.2 STEAM TO HOT WATER CONVERTER/COOLING TOWERS/PUMPS (COUNTY SIDE VRF CONDENSER LOOP)

- A. Replace/upgrade the existing BAS control panel and all field installed sensors as required to maintain the existing sequence of operation as outlined herein through integration with the new BAS.
- B. Provide temperature sensors in heating water supply and return piping near the inlet and outlet of the heat exchanger.
- C. Provide a flow switch to prove CWS flow. Whenever the pumps are not running, the steam control valves shall be fully closed.

- D. Supplemental Heat: Enable converter system at 55°F (adj.) or colder OA temperature and the steam system is enabled. Enable pump, at proof of CWS flow, the 1/3 and 2/3 capacity steam control valves shall be modulated in sequence to maintain the CWS temperature.
  - 1. On a demand for heating, the small valve shall modulate open. Upon demand for steam beyond the capacity of the small valve for a period of five minutes, the small valve shall close, and the large valve shall assume the load. Upon a demand for steam beyond the capacity of the large valve for a period of five minutes, the small valve shall be re-enabled and both valves shall operate in unison.
  - 2. With both valves operating, as the total demand drops below the capacity of the large valve for five minutes, the small valve shall close. With the large valve operating, as the demand drops below the capacity of the small valve for five minutes, the large valve shall close, and the small valve shall assume the load.
  - 3. Valve timings and parameters shall be field adjustable.
- E. Provide a deadband between heat addition and heat rejection.
- F. Heat rejection Controls -closed circuit cooler (CCC):
  - 1. Existing heat rejection control shall be maintained for the existing towers. The towers shall be operated together, with fan speeds modulating in unison for control as follows:
    - a. With loop flow proven, and the loop water temperature rises above setpoint, initiate first stage cooling which opens the CCC discharge dampers.
    - b. With discharge dampers proven open, and the continued rise in loop temperature above setpoint, start the CCC recirculating pumps.
    - c. When the loop water supply temperature reaches 86°F, start the CCC fans at low speed.
    - d. Modulate the CCC fan speeds to maintain nominal heat rejection loop supply temperature at 85 degrees (adj).
    - e. The sequence shall take place in reverse order upon a drop in loop temperature, minimum 3-minute run time for each step.
  - 2. Sump Heater
    - a. Input Device: Sump temperature sensor.
    - b. Output Device: Electric relay
    - c. Action: Energize sump heater to maintain 40 minimum sump temperature.
- G. Existing Condenser Water Loop Pumps (Existing VFD's shall remain): Control for pumps shall remain as currently operating whereby existing pumps are energized during occupied cycle and modulate to maintain system differential pressure based upon water cooled condensing unit operation.
- H. Operator Workstation: Display the following data:
  - 1. Outside temperature.
  - 2. Loop supply temperature, downstream of heat source.
  - 3. Loop supply temperature, downstream of closed circuit cooler.

- 4. Loop supply water supply temperature set points.
- 5. Loop return temperature to closed circuit coolers.
- 6. Loop return water supply temperature set point.
- 7. Operating status of heat injection pump.
- 8. Position of CCC discharge dampers.
- 9. Status of CCC pumps.
- 10. Status of fan motors.
- 11. Speed of fan motors.

## 2.3 CHILLER PLANT (STATE SIDE FACILITY)

- A. Input points from chiller panels to BAS system
  - 1. Remote mode ready to start contact dry contact on the chiller panel to the BAS system that indicates the chiller is ready for remote start
  - 2. Cycling shutdown dry contact on the chiller panel indicating to the BAS system that chiller is not allowed to start due to an internal sequence cycle device
  - 3. Safety shutdown contact dry contact on the chiller panel indicating to the BAS system that the chiller has shutdown or can't start due to a safety circuit
  - 4. Run Contacts dry contact on the chiller panel indicating to the BAS system that the chiller is running
  - 5. Chiller amps current sensor provided and installed by the BAS contractor to monitor amps on one phase of the chiller power feed. To be used for chiller capacity calculation.
- B. Output points from BAS system to chiller panels
  - 1. Start/Stop NO start contact and NC stop contact from the BAS system to the chiller panel. A single DPDT output relay is used for these contacts to start and stop the chiller from the BAS system.
  - 2. Chilled water temperature setpoint The chiller shall include a remote chilled water reset card that shall accept a 0-10VDC signal from the BAS system. This BAS output shall be used to reset chilled water temperature setpoint.
  - 3. Current limit setpoint The chiller shall include a remote current limit setpoint card that shall accept a 0-10VDC signal from the BAS system. This BAS output shall be used to reset chiller capacity during multi-unit start-up sequence.
- C. Alarms
  - 1. All alarm messages generated at the operator's station shall consist of descriptive English language text indicating the time, date and exact nature of the alarm condition.
  - 2. A high and low limit shall be programmed into all temperature, status, flow, and pressure sensors. If alarm levels are exceeded an alarm shall be generated and logged by the BAS system at the workstations.
  - 3. The pump status will be monitored by the BAS controller through current sensors and VFD status inputs as shown on point summary. If the commanded status at the output differs from the measured status on the status input an alarm shall be generated by the BAS system at the operator's workstation.
  - 4. Upon chiller failure, pump failure, high or low chilled water temperature or high or low condenser water temperature a detailed alarm message shall be sent to all workstations.

- D. Chilled Water Pump Control
  - 1. When outside air temperature rises above 55°F (adjustable) and the average AHU chilled water valve position is greater than 30% open (adjustable) the lead chilled water pump shall be started and shall run continuously. Upon proof of chilled water flow the chiller shall be enabled to start by the BAS system.
  - 2. Once enabled, the chiller shall modulate under its manufacturer supplied controls to maintain discharge chilled water setpoint subject to a 0-10VDC setpoint control signal and 0-10VDC capacity control signal from the BAS System.
  - 3. Chilled water pumps, once enabled, shall operate through integral VFD to maintain differential pressure setpoint at the chilled water loop.
  - 4. Lead and lag pumps shall be rotated to maintain equal runtime. Lead/lag selection shall be changed only when all pumps and chillers are shut down.
- E. Chilled Water Minimum Flow-Bypass Valve Control
  - 1. System bypass valve shall modulate to maintain differential pressure setpoint across the evaporator barrel. The setpoint shall be determined by the TAB contractor to maintain the minimum flow through the chiller (200 gpm).
- F. Chilled Water Setpoint Control
  - 1. The BAS system shall monitor chilled water discharge temperature at the chiller.
  - 2. Upon a failure in any chiller or pump detected by the BAS chiller alarm inputs or chilled water flow sensor the chiller shall be shutdown and the next lag chiller and pump(s) shall be sequenced on in its place.
- G. Operator Station Display: Indicate the following on operator workstation display terminal:
  - 1. System graphic.
  - 2. Pump on-off indication, typical for all pumps.
  - 3. Chilled-water pump on-off switch.
  - 4. Chilled water pump speed.
  - 5. Chiller on-off indication.
  - 6. Chiller chilled-water supply and return temperature.
  - 7. Chiller-water control-point adjustment.
  - 8. Bypass valve command and position
  - 9. Evaporator Barrel DP setpoint and actual
  - 10. Chilled water system DP setpoint and actual
  - 11. VFD fault
  - 12. VFD Hz.

- 2.4 BYPASS VAV PACKAGE ROOFTOP AC UNIT (EXISTING FEENEY CONFERENCE ROOM)
  - A. Furnish and install an application controller for this system.
  - B. Occupied Mode:
    - 1. Supply fan operate continuously.
    - 2. OA damper to minimum OA, RA/EA dampers to occupied ventilation positions.
  - C. Unoccupied Mode:
    - 1. OA/EA dampers closed, RA damper 100% Open.
    - 2. Unit cycles on as required to maintain unoccupied heating setpoint within the zones served (refer to terminal VAV w/reheat control elsewhere herein).
  - D. Cooling Control:
    - 1. On call for space cooling based upon zone temperature sensors, cooling is enabled and Dx cooling is staged to maintain discharge air temperature at setpoint (55 deg, adj).
  - E. Economizer Cooling:
    - 1. On call for space cooling, with OA enthalpy lower than RA enthalpy, modulate OA damper from minimum position to 100% open and modulate in sequence RA damper to 100% closed to maintain discharge air temperature setpoint.
    - 2. Power exhaust fan shall be enabled at 70%, (adj) OA.
  - F. Heating Control:
    - 1. On fall in discharge air temperature below setpoint, based a reset schedule (65 deg at 10 deg ambient and 57 deg at 40 deg ambient), heating coil control valve shall modulate open to maintain discharge air temperature at setpoint.
  - G. Supply Duct Pressure Control:
    - 1. Duct mounted static pressure sensor shall modulate bypass damper open to maintain duct static pressure at setpoint.

## 2.1 SPLIT SYSTEM AC UNIT (EXISTING COURTROOM 11)

- A. Furnish and install an application controller for this system.
- B. Occupied Mode:
  - 1. Supply fan operate continuously.
  - 2. OA damper to minimum OA, RA/EA dampers to occupied ventilation positions.

- C. Unoccupied Mode:
  - 1. OA/EA dampers closed, RA damper 100% Open.
  - 2. Unit cycles on as required to maintain unoccupied heating setpoint within the zone served.
- D. Cooling Control:
  - 1. On call for space cooling based upon zone temperature sensor, cooling is enabled and Dx cooling is staged to maintain space temperature at setpoint (55 deg, adj).
- E. Economizer Cooling:
  - 1. On call for space cooling, with OA enthalpy lower than RA enthalpy, modulate OA damper from minimum position to 100% open and modulate in sequence RA damper to 100% closed to maintain space temperature setpoint.
- F. Heating Control:
  - 1. On fall in space temperature below setpoint, heating coil control valve shall modulate open to maintain space temperature at setpoint.

# 2.1 CONSTANT VOLUME SPLIT AC SYSTEM WITH REHEAT (EXISTING JURY DELIBERATION AREA)

- A. Furnish and install an application controller for this system.
- B. Occupied Mode:
  - 1. Supply fan operate continuously.
  - 2. OA damper to minimum OA, RA/EA dampers to occupied ventilation positions.
- C. Unoccupied Mode:
  - 1. OA/EA dampers closed, RA damper 100% Open.
  - 2. Unit cycles on as required to maintain unoccupied heating setpoint within the zones served (refer to reheat coil control elsewhere herein).
- D. Cooling Control:
  - 1. On call for space cooling based upon zone temperature sensors, cooling is enabled and Dx cooling is staged to maintain discharge air temperature at setpoint (55 deg, adj).

- E. Economizer Cooling:
  - 1. On call for space cooling, with OA enthalpy lower than RA enthalpy, modulate OA damper from minimum position to 100% open and modulate in sequence RA damper to 100% closed to maintain discharge air temperature setpoint.
- F. Heating Control:
  - 1. On fall in discharge air temperature below setpoint, based a reset schedule (65 deg at 10 deg ambient and 57 deg at 40 deg ambient), heating coil control valve shall modulate open to maintain discharge air temperature at setpoint.

# 2.2 ROOFTOP UNITS – NEW AC-1 AND EXISITNG AC-2

- A. For the existing AC-2 unit, the existing Siemens controller shall be upgraded or replaced with a new application controller as required for complete integration with the new BAS. Existing temperature, pressure, and CO2 sensors may be retained for reuse. Existing damper actuators may be retained for reuse, and existing flow rings at the fans may be retained for use with the new BAS controller to maintain control as outlined herein.
- B. For the new AC-1 unit, provide al hardware, software, and programming as required to support the control sequence herein. Refer also to Section 237314 for additional information.
- C. Zone-Group Operating Modes: Zone Groups are sets of zones served by a single RTU that operate together for ease of scheduling.
  - 1. Occupied Mode.
  - 2. Optimal Start/Stop: The algorithms used in these modes (often referred to as "optimal start") shall predict the shortest time to achieve occupied set point to reduce the central system energy use based on past performance.
    - a. Warm-Up Mode. For each zone, the BAS shall calculate the required warm-up time based on the zone's occupied heating set point, the current zone temperature, the OA temperature, and a mass/capacity factor for each zone. The mass factor shall be manually adjusted or self-tuned by the BAS. If automatic, the tuning process shall be turned on or off by a software switch to allow tuning to be stopped after the system has been trained. Warm-up mode shall start based on the zone with the longest calculated warm-up time requirement, but no earlier than 3 hours before the start of the scheduled occupied period and shall end at the scheduled occupied start hour.
    - b. Cooldown Mode. For each zone, the BAS shall calculate the required cooldown time based on the zone's occupied cooling set point, the current zone temperature, the OA temperature, and a mass/capacity factor for each zone. The mass factor shall be manually adjusted or self-tuned by the BAS. If automatic, the tuning process shall be turned on or off by a software switch to allow tuning to be stopped after the system has been trained. Cooldown mode shall start based on the zone with the longest calculated cooldown time requirement, but no earlier than 3 hours before the start of the scheduled occupied period and shall end at the scheduled occupied start hour.

- 3. Setback Mode. During unoccupied mode, if any 5 zones (or all zones if fewer than 5) in the zone group fall below their unoccupied heating set points, or if the average zone temperature of the zone group falls below the average unoccupied heating set point, the zone group shall enter setback mode until all spaces in the zone group are 2°F above their unoccupied set points.
- 4. Freeze Protection Setback Mode. During unoccupied mode, if any single zone falls below 40°F, the zone group shall enter setback mode until all zones are above 45°F, and a Level 3 alarm shall be set.
- 5. Unoccupied mode: Unit OFF, dampers closed to OA.
- D. Supply Fan Control: Supply Fan Start/Stop
  - 1. Supply fan shall run when system is in the Cooldown Mode, Setup Mode, or Occupied Mode.
  - 2. If there are any VAV-reheat boxes on perimeter zones, supply fan shall also run when system is in Setback Mode or Warmup Mode (i.e., all modes except unoccupied).
  - 3. SA flow measurement: Totalize the airflow rate from VAV boxes to a software point Vps (Vps is the sum of the zone primary airflow rates Vpz as measured by VAV boxes for all zones in all Zone Groups that are in Occupied Mode).
- E. Provide fan fault alarms per Paragraph 1.3 "Alarms".
- F. Static Pressure Control:
  - 1. Static pressure sensors used to control VAV fans shall be located such that the controller set point is no greater than 1.2 in. of water. If this results in the sensor being located downstream of major duct splits, sensors shall be provided in each major branch to ensure that static pressure can be maintained in each.
  - 2. Supply fan speed is controlled to maintain DSP at setpoint when the fan is proven ON.
  - 3. Static Pressure Set-Point Reset: Static pressure setpoint shall be reset using T&R logic per 5.16.1.2. Static Pressure Set-Point Reset. The T&R reset parameters are suggested as a starting point; they will most likely require adjustment during the commissioning / tuning phase.
    - a. At a frequency of once every 2 minutes (adj), the system controller shall monitor the damper position and airflow of all VAV terminal units. The system controller shall calculate a new supply fan duct static pressure setpoint based on the criteria shown below, and send this newly-calculated setpoint to the AHU controller. All values below are adjustable:
      - 1) If the measured airflow is less than 50% of set point while set point is greater than zero and the damper position is greater than 95% for 1 minute, send 3 requests.
      - 2) Else if the measured airflow is less than 70% of set point while set point is greater than zero and the damper position is greater than 95% for 1 minute, send 2 requests.
      - 3) Else if the damper position is greater than 95%, send 1 request until the damper position is less than 85%.
      - 4) Else if the damper position is less than 95%, send 0 requests.

- b. System shall default to ignoring the first 2 requests (adj). When Requests > Ignores the system shall respond by adjusting setpoint upward by (Requests Ignores) \* .06 inH20 (adj), but no larger than .13 inH20 (adj). When Requests are equal to, or less than Ignores the setpoint shall be reset downward by -.05 inH20 (adj). Setpoint shall be bound by a minimum and maximum value which can be set per air handler.
- G. Guideline 36 Paragraph 5.16.2. SA Temperature Control
  - 1. Control loop is enabled when the SA fan is proven ON.
  - 2. SA Temperature Setpoint
    - a. Temperature setpoints. The T&R reset parameters are suggested as a starting place; they will most likely require adjustment during the commissioning/tuning phase.
      - 1) Min\_ClgSAT: 55°F
      - 2) Max\_ClgSAT: 60°F
      - 3) OAT Min:  $60^{\circ}$ F
      - 4) OAT Max: 70°F
    - b. Ensure that all coil controls have common inputs and do not overlap in function. Provide a deadband between heating and cooling stages.
    - c. During Occupied Mode and Setup Mode, setpoint shall be reset from Min\_ClgSAT when the OA temperature is OAT\_Max and above, proportionally up to T-max when the OA temperature is OAT\_Min and below. T-max shall be reset using T&R logic between Min\_ClgSAT and Max\_ClgSAT.
    - d. Guideline 36 Paragraph 5.16.2.3: SA temperature shall be controlled to setpoint using a control loop whose output is mapped to sequence the heating coil (if applicable), OA damper, RA damper, and cooling coil (if applicable). The heating coil, mixed air dampers, and the cooling coil shall be controlled in sequence to maintain the SA setpoint temperature. At no time shall the heating coil be operating when the mixed air dampers are economizing, or the chilled water coil valve is open.
    - e. Whenever the SAT is above the setpoint, the following shall occur in sequence:
      - 1) The gas heating shall be disabled. When heating is completely off and the economizer sequence is enabled, the economizer OA damper and RA damper shall be modulated sequentially (OA damper modulates open fully before RA damper modulates towards closed) to maintain the SA temperature setpoint.
      - 2) When the OA economizer damper is completely open and the RA damper is completely closed, or the economizer sequence is not enabled, the chilled water valve shall modulate open to maintain the SA temperature setpoint.
    - f. When the SA setpoint is below setpoint the reverse shall occur. Cooling coil control shall be locked out below 50° F (adj.) OA temperature.
    - g. Gas Heating Stages: Stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.

3. Cooling Coil

Chilled water: modulate 2-way control valve to maintain discharge air temperature setpoint.

- 4. Economizer cooling:
  - a. Air economizer systems shall be capable of and configured to modulate OA and RA dampers to provide up to 100% of the design SA quantity as OA for cooling.
  - b. Economizer controls shall be capable of and configured to sequence the dampers with the mechanical cooling equipment and shall not be controlled by only mixed-air temperature.
  - c. Economizer systems shall be integrated with the mechanical cooling system and be capable of and configured to provide partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not falsely load the mechanical cooling systems by limiting or disabling the economizer or by any other means except at the lowest stage of mechanical cooling.
  - d. Unit controls shall have the mechanical cooling capacity control interlocked with the air economizer controls such that the OA damper is at the 100% open position when mechanical cooling is on, and the OA damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F.
  - e. Guideline 36 Paragraph 5.1.17. Air Economizer High Limits: Air economizers shall be capable of and configured to automatically reduce OA intake to the design minimum OA quantity when OA intake will no longer reduce cooling energy use. Provide differential enthalpy + fixed dry bulb; economizer shall be off when:
    - 1) hOA > hRA
    - 2)  $TOA > 75^{\circ}F$
- 5. Provide fault detection & diagnostics (FDD) for economizer systems.
  - a. The following temperature sensors shall be permanently installed to monitor system operation. Temperature sensors shall have an accuracy of  $\pm 2^{\circ}F$  over the range of 40°F to 80°F.
    - 1) Outside air.
    - 2) Supply air.
    - 3) Return air.
  - b. The system or unit controls shall be configured to provide system status by indicating the following:
    - 1) Free cooling available.
    - 2) Economizer enabled.
    - 3) Cooling enabled.
    - 4) Heating enabled.
    - 5) Mixed air low limit cycle active.
    - 6) The current value of each sensor.

- c. The system or unit controls shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans, and the heating system can be independently tested and verified.
- d. The unit shall be configured to report faults to the BAS.
- e. The FDD system shall be configured to detect the following faults:
  - 1) Air temperature sensor failure/fault.
  - 2) Not economizing when the unit should be economizing.
  - 3) Economizing when the unit should not be economizing.
  - 4) Damper not modulating.
  - 5) Excess OA.
- H. Minimum OA Control: The OA damper and RA damper shall modulate independently, and in a sequence, to maintain outside airflow at scheduled minimum. The OA flow setpoint shall be as scheduled and determined at the time of TAB in conjunction with the balancing contractor.
- I. Demand Control Ventilation (DCV): The OA damper shall modulate open and RA damper closed to maintain CO2 concentration-refer also to terminal VAV sequence herein.
- J. AC Unit Return-Fan Control Offset (AC-1 and AC-2)
  - 1. Return fan shall run whenever associated supply fan is proven ON.
  - 2. The SF and RF drive outputs shall be independently controlled in order to provide the control needed to maintain building pressure control. The RF VFD shall track the SF VFD minus an adjustable OFFSET between SF and RF speed. The SF and corresponding RF volumes shall be determined by VFD position at both MAX and MIN AHU airflow conditions.
  - 3. OFFSET CFM = RA SA (building exhaust fan CFM + building pressure). Building pressure is assumed to be +200 CFM for each AH.
  - 4. The tracking relationship (OFFSET) shall be established during the TAB phase to account for the various exhaust fans. The OFFSET values are adjustable, final values to be confirmed to allow for building pressurization during the TAB phase.
  - 5. The OFFSET determined during TAB shall be displayed in non-adjustable static text next to the adjustable value on the Graphics. The intent being that should someone change the value, they can change it back to the balanced value should they not achieve their expected results.
- K. AC-1 Existing in-line return fans (duct mounted):
  - 1. Fan speed shall modulate to maintain static pressure at base of exhaust riser at setpoint (0" wc adjustable).
- L. Safeties:
  - 1. The supply fan and all BAS Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hard-wire interlocked to the fan starter circuit. BAS Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

- 2. Shall stop the supply fan; cause the system valves and dampers to return to their normal positions.
- 3. High limit static-pressure controller located in fan discharge stops fan and signals Level 2 alarm when static pressure rises above excessive-static-pressure set point.
- 4. BAS Hardware reset of all proofs and safeties shall be via a local binary push-button input to the BAS Hardware.
- 5. Duct smoke detectors shall be provided in supply & RA streams and as indicated on the plans. Provide in ductwork and connect to the BAS by Division 23. Detector shall be furnished and wired to the fire alarm system by Division 26. Activated when products of combustion are detected in air stream. Smoke detector shall signal a Level 1 alarm, stops supply fan when products of combustion are detected in airstream. Restarting the supply fan shall require manual reset at the smoke detector.
- 6. DA high temperature limit is 105°F (adj) and low temperature limit is 50°F (adj).
- 7. A differential pressure sensor shall be provided across the filters. The system shall generate a Level 4 alarm the filter high limit threshold. The alarm set points shall be adjustable. The filter high limit differential pressure threshold shall be determined as the maximum recommended filter pressure drop at design airflow by the filter manufacturer.

# 2.3 ENERGY RECOVERY VENTILATORS (SALLYPORT AND COUNTY SIDE VRF SYSTEMS)

- A. ERV With No Heating or Cooling (County Side VRF):
  - 1. Occupied mode:
    - a. Normally closed OA and exhaust dampers shall be open.
    - b. Supply and Exhaust fans operate continuously during occupied hours, subject to damper end switches.
    - c. Provide fan fault alarms per Paragraph 1.3 "Alarms".
  - 2. Unoccupied mode:
    - a. OA and EA dampers 100% closed.
    - b. Fans off.
- B. ERV with Duct Mounted Heating Coil (Sallyport)
  - 1. BAS dictates occupied/unoccupied operation (programmable based upon 24 hour per day, seven days per week). Supply and exhaust fans operate continuously in occupied mode, exhaust and fresh air dampers open. Supply and exhaust fans are de-energized in unoccupied mode, exhaust and fresh air dampers closed. Fresh air and exhaust air motorized dampers shall fail-closed.
  - 2. Fans energize subject to damper end switches.
  - 3. Duct mounted heating coil control valve shall modulate between high and low temperature limits to maintain return air temperature at 70 degrees (adjustable through BAS). Discharge air low limit shall be set at 55 degrees (adjustable) and high limit set at 85 degrees (adjustable). Heating control valve shall fail open on a loss of power and during night shutdown.

- 4. Freeze protection is by capillary tube thermostat with manual reset mounted on the discharge of the unit. When temperature setpoint 40 F (adj) is detected the fans stop, EA and OA dampers close 100%, heating coil control valve wide open.
- 5. Frost control and economizer control shall be via unit mounted controller. BMS shall interface with unit controller as required for operation as specified.
- C. Display of input points thru BAS:
  - 1. System occupied/unoccupied mode.
  - 2. Supply fan status/failure (Print out Alarm)
  - 3. Exhaust fan status/failure (Print out Alarm)
  - 4. OA commanded damper position.
  - 5. EA commanded damper position.
  - 6. OA temperature
  - 7. DA temperature.
  - 8. RA temperature.
  - 9. EA temperature.
  - 10. High DA limit (Print out Alarm).
  - 11. Low DA limit (Print out Alarm).
  - 12. HW valve position
  - 13. Filter air-pressure-drop indication (Print out at setpoint).
- D. Safeties:
  - 1. The supply fan and all BAS Hardware control loops shall be subject to Proofs and Safeties. Safeties shall be direct-hard-wire interlocked to the fan starter circuit. BAS Hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.
  - 2. Shall stop the supply fan; cause the system valves and dampers to return to their normal positions.
  - 3. BAS Hardware reset of all proofs and safeties shall be via a local binary push-button input to the BAS Hardware.
  - 4. Freeze Protection: Upon signal from the freeze-stat, or if SA temperature drops below 38°F for 15 minutes or below 34°F for 5 minutes, shut down fans, close OA/EA damper, open the coil valves to 100%, and energize the pump systems. Also send two (or more, as required to ensure that heating plant is active) heating hot-water plant requests, modulate the heating coil to maintain the higher of the SA temperature or the mixed air temperature at 80°F, and set a Level 2 alarm indicating the unit is shut down by freeze protection. If a freeze-protection shutdown is triggered by a low air temperature sensor reading, it shall remain in effect until it is reset by a software switch from the operator's workstation. (If a freeze-stat with a physical reset switch is used instead, there shall be no software reset switch.)
  - 5. A differential pressure sensor shall be provided across the filters. The system shall generate a Level 4 alarm the filter high limit threshold. The alarm set points shall be adjustable. The filter high limit differential pressure threshold shall be determined as the maximum recommended filter pressure drop at design airflow by the filter manufacturer.

## 2.4 TERMINAL UNITS – COMMON REQUIREMENTS

- A. Each zone shall have separate occupied and unoccupied heating and cooling setpoints.
- B. The active setpoints shall be determined by the operating mode of the Zone Group. Zone scheduling groups, or Zone Groups, are sets of zones served by a single air handler that operate together for ease of scheduling and/or in order to ensure sufficient load to maintain stable operation in the upstream equipment.
  - 1. The set points shall be the occupied set points during occupied mode, warm-up mode, and cooldown mode.
  - 2. The set points shall be the unoccupied set points during unoccupied mode, setback mode, and setup mode.
- C. The software shall prevent the following:
  - 1. The heating setpoint from exceeding the cooling setpoint minus 1°F (i.e., the minimum difference between heating and cooling setpoints shall be 1°F).
  - 2. The unoccupied heating setpoint from exceeding the occupied heating setpoint.
  - 3. The unoccupied cooling setpoint from being less than the occupied cooling setpoint.
- D. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
  - 1. The adjustment shall be capable of being limited in software.
    - a. As a default, the active occupied cooling setpoint shall be limited between 73°F and 80°F.
    - b. As a default, the active occupied heating setpoint shall be limited between  $65^{\circ}F$  and  $72^{\circ}F$ .
  - 2. The active heating and cooling setpoints shall be independently adjustable, respecting the limits and anti-overlap logic. If zone thermostat provides only a single set-point adjustment, then the adjustment shall move both the active heating and cooling setpoints upward or downward by the same amount.
  - 3. The adjustment shall only affect occupied setpoints in Occupied Mode, Warmup Mode, and Cooldown Mode and shall have no impact on setpoints in all other modes.
- E. A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time (60 minutes, adj.). At the expiration of this time, control of the unit shall automatically return to the schedule.
- F. Control Loops
  - 1. Two separate control loops, the Cooling Loop, and the Heating Loop, shall operate to maintain space temperature at setpoint.
    - a. The Heating Loop shall be enabled whenever the space temperature is below the current zone heating set-point temperature and disabled when space temperature is above the current zone heating setpoint temperature, and the loop output is zero for

30 seconds. The loop may remain active at all times if provisions are made to minimize integral windup.

- b. The Cooling Loop shall be enabled whenever the space temperature is above the current zone cooling set-point temperature and disabled when space temperature is below the current zone cooling set-point temperature and the loop output is zero for 30 seconds. The loop may remain active at all times if provisions are made to minimize integral windup.
- 2. The Cooling Loop shall maintain the space temperature at the active cooling setpoint. The output of the loop shall be a software point ranging from 0% (no cooling) to 100% (full cooling).
- 3. The Heating Loop shall maintain the space temperature at the active heating setpoint. The output of the loop shall be a software point ranging from 0% (no heating) to 100% (full heating).
- 4. Loops shall use proportional + integral logic or other technology with similar performance. Proportional-only control is not acceptable, although the integral gain shall be small relative to the proportional gain. P and I gains shall be adjustable by the operator.
- 5. See other sections for how the outputs from these loops are used.
- G. Zone Temperature Alarms
  - 1. High-temperature alarm
    - a. If the zone is 3°F above cooling setpoint for 10 minutes, generate a Level 4 alarm.
    - b. If the zone is 5°F above cooling setpoint for 10 minutes, generate a Level 3 alarm.
  - 2. Low-temperature alarm
    - a. If the zone is 3°F below the heating setpoint for 10 minutes, generate a Level 4 alarm.
    - b. If the zone is 5°F below the heating setpoint for 10 minutes, generate a Level 3 alarm.
  - 3. Suppress zone temperature alarms as follows:
    - a. After zone setpoint is changed.
    - b. While Zone Group is in Warmup Mode or Cooldown Mode.

## 2.5 TERMINAL UNITS – SPECIFIC REQUIREMENTS

- A. Zone Reheat Coils-modulating control valve (Jury Deliberation and Feeney Conference Room Suite):
  - 1. Input Device: Electronic temperature sensor.
  - 2. Modulate hot water control valve to maintain zone temperature.

- B. Terminal Heating Units, 2-position valve controlled Fintube, convectors, radiant heating panels (typical all spaces at the Stateside Facility):
  - 1. Input Device: Electronic temperature sensor.
  - 2. Open/close valve to maintain temperature.
  - 3. Heating Hot-Water Plant Requests. Send the heating hot-water plant that serves the coil a heating hot-water plant request as follows:
    - a. If the space does not heat to setpoint within 5 minutes, send 1 request.
    - b. If there are no requests for 5 minutes, send 0 requests.
  - 4. For zones with associated perimeter heating, modulate electronic control perimeter heating HW valve in sequence (simultaneously) with reheat coil to maintain space temperature.
- C. Unit Heaters Hydronic
  - 1. Input Device: Electronic temperature sensor.
  - 2. Provide a strap on aquastat mounted on the hot water return line set at 100°F to control the unit fan when hot water temperature is above setpoint.
  - 3. Upon a drop-in space temperature below the heating setpoint, the fan shall start, and the HW valve shall open. When the temperature rises above the setpoint, the fan shall stop, and the valve shall close. Minimum run time: 1 minute.
  - 4. ASHRAE 90.1-2016: Heating for vestibules shall include automatic controls capable of and configured to shut off the heating system when OA temperatures are above 45°F.
  - 5. Heating Hot-Water Plant Requests. Send the heating hot-water plant that serves the coil a heating hot-water plant request as follows:
    - a. If the space does not heat to setpoint within 5 minutes, send 1 request.
    - b. If there are no requests for 5 minutes, send 0 requests.

# 2.6 VAV TERMINAL UNITS

- A. VAV Terminal Unit with Reheat Active endpoints used in the control logic depicted in Figure 5.6.5 shall vary depending on the mode of the Zone Group the zone is a part of (see Table 5.6.4).
- B. Provide VAV Terminal Unit with Reheat Control logic as shown in Figure 5.6.5 and described in the following subsections.

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Table 5.6.4 Endpoints as a Function of Zone Group Mode

Endpoint	Occupied	Cooldown	Setup	Warmup	Setback	Unoccupied
Cooling maximum	Vcool-max	Vcool-max	Vcool-max	0	0	0
Cooling minimum	Vmin*	0	0	0	0	0
Minimum	Vmin*	0	0	0	0	0
Heating minimum	Max (Vheat-min, min*)	Vheat-min	0	Vheat-max	Vheat-max	0
Heating maximum	Max (Vheat-max, min*)	Vheat-max	0	Vcool-max	Vcool-max	0

D.

C.

- 1. When the Zone State is cooling, the cooling-loop output shall be mapped to the active airflow setpoint from the cooling minimum endpoint to the cooling maximum endpoint. Heating coil is disabled unless the DAT is below the minimum setpoint (50°F).
  - a. If SA temperature from the air handler is greater than room temperature, the active airflow setpoint shall be no higher than the minimum endpoint.
- 2. When the Zone State is deadband, the active airflow setpoint shall be the minimum endpoint. Heating coil is disabled unless the DAT is below the minimum setpoint (50°F).
- 3. The purpose of the following heating sequence is to minimize the reheat energy consumption by first increasing the SAT while maintaining minimum flow, and only increasing the total airflow if needed to satisfy the zone: When the Zone State is heating, the Heating Loop shall maintain space temperature at the heating setpoint as follows:
  - a. From 0% to 50%, the heating-loop output shall reset the discharge temperature setpoint from the current AHU SAT setpoint to a maximum of Max $\Delta$ T above space temperature setpoint. The active airflow setpoint shall be the heating minimum endpoint.
  - b. From 51% to 100%, if the DAT is greater than room temperature plus 5°F, the heating loop output shall reset the active airflow setpoint from the heating minimum endpoint to the heating maximum endpoint.

- c. The heating coil shall be modulated to maintain the discharge temperature at setpoint. (Directly controlling heating off the zone temperature control loop is not acceptable).
- 4. In Occupied Mode, the heating coil shall be modulated to maintain a DAT no lower than 50°F.
- 5. The VAV damper shall be modulated by a control loop to maintain the measured airflow at the active setpoint.



- E. VAV Alarms: Provide per Guideline 36 Paragraph 5.6.6.
  - 1. Low Airflow
  - 2. Low-SA Temperature
  - 3. Airflow Sensor Calibration. If the fan serving the zone is OFF and airflow sensor reading is above the larger of 10% of the cooling maximum airflow setpoint or 50 cfm for 30 minutes, generate a Level 3 alarm.
  - 4. Leaking Damper. If the damper position is 0%, and airflow sensor reading is above the larger of 10% of the cooling maximum airflow setpoint or 50 CFM for 10 minutes while the fan serving the zone is proven ON, generate a Level 4 alarm.
  - 5. Leaking Valve. If the valve position is 0% for 15 minutes, DAT is above AHU SAT by 5°F, and the fan serving the zone is proven ON, generate a Level 4 alarm.
- F. VAV Testing/Commissioning Overrides. Provide software switches that interlock to a system level point to:
  - 1. force zone airflow setpoint to zero,
  - 2. force zone airflow setpoint to Vcool-max,
  - 3. force zone airflow setpoint to Vmin,
  - 4. force zone airflow setpoint to Vheat-max,
  - 5. force damper full closed/open,
  - 6. force heating to OFF/closed, and
  - 7. reset request-hours accumulator point to zero (provide one point for each reset type listed in the next section).

- G. VAV System Requests
  - 1. Cooling SAT Reset Requests
    - a. If the zone temperature exceeds the zone's cooling setpoint by 5°F for 2 minutes and after suppression period due to setpoint change, send 3 requests.
    - b. Else if the zone temperature exceeds the zone's cooling setpoint by 3°F for 2 minutes and after suppression period due to setpoint change, send 2 requests.
    - c. Else if the Cooling Loop is greater than 95%, send 1 request until the Cooling Loop is less than 85%.
    - d. Else if the Cooling Loop is less than 95%, send 0 requests.
  - 2. Static Pressure Reset Requests
    - a. If the measured airflow is less than 50% of setpoint while setpoint is greater than zero and the damper position is greater than 95% for 1 minute, send 3 requests.
    - b. Else if the measured airflow is less than 70% of the setpoint while the setpoint is greater than zero and the damper position is greater than 95% for 1 minute, send 2 requests.
    - c. Else if the damper position is greater than 95%, send 1 request until the damper position is less than 85%.
    - d. Else if the damper position is less than 95%, send 0 requests.
  - 3. If There Is a Hot-Water Coil, Hot-Water Reset Requests
    - a. If the DAT is 30°F less than the setpoint for 5 minutes, send 3 requests.
    - b. Else if the DAT is 15°F less than the setpoint for 5 minutes, send 2 requests.
    - c. Else if HW valve position is greater than 95%, send 1 request until the HW valve position is less than 85%.
    - d. Else if the HW valve position is less than 95%, send 0 requests.
  - 4. If There Is a Hot-Water Coil and Heating Hot-Water Plant Requests. Send the heating hot-water plant that serves the zone a heating hot-water plant request as follows:
    - a. If the HW valve position is greater than 95%, send 1 request until the HW valve position is less than 10%.
    - b. Else if the HW valve position is less than 95%, send 0 requests.
- H. For VAV zones with CO2 sensors: When in the occupied mode, the controller shall measure the zone CO2 concentration and modulate the zone damper open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of not more than 750 ppm (adj.).
- I. For zones with associated perimeter heating, modulate electronic control perimeter heating HW valve in sequence (simultaneously) with reheat coil to maintain space temperature when associated AHU is running. When space temperature is below setpoint modulate the HW valve open. The reverse shall occur when space temperature is above setpoint. When the associated AHU is off, the radiation valve shall be modulated to maintain heating setpoint and the

associated reheat valve shall be closed. Close the perimeter heating valve closed whenever OA is above  $50^{\circ}$  F (adj.).

# 2.7 EXHAUST FANS

- A. Fan Alarms
  - 1. Maintenance interval alarm when fan has operated for more than 3,000 hours: Level 4. Reset interval counter when alarm is acknowledged.
  - 2. Provide fan fault alarms per Paragraph 1.3 "Alarms".
  - 3. Damper Failure: Commanded open, but the status is closed; Level 2.
- B. This room temperature control method should only be used in non-occupied spaces where ventilation is not required (e.g., equipment rooms) Heat Relief: Provide end switches for dampers. The intake/exhaust air dampers shall open anytime the unit runs and shall close anytime the unit stops. The fan shall be enabled after the damper end switch status has been proven. Fan shall run when zone temperature rises above the active cooling setpoint until zone temperature falls more than 2°F below the active cooling setpoint for 2 minutes. Provide a Level 3 alarm if the zone temperature is greater than the cooling setpoint by a user definable amount (adj.). This sequence applies to the following fans:
  - 1. Existing EF-5
- C. Scheduled (Time): Exhaust fan shall operate when any of the associated system air handlers are proven on, and any associated Zone Group is in the Occupied Mode. The sequence applies to the following fans:
  - 1. Existing EF-1, EF-2, EF-3, EF-4, EF-6, and EF-8

# 2.8 DAIKIN WATER COOLED VRF INTEGRATION

- 1. Provide integration via Bacnet interface with the existing Daikin ITouch Manager serving the water cooled VRF Heat Pump System at the County Side facility to allow for system monitoring, alarming, and setpoint adjustment. The VRF system shall be controlled via its manufacturer-provided controls as required to maintain space temperature setpoints. This includes, but is not limited to indoor unit fan control, compressor staging and modulation, condenser fan operation, and heat/cool mode changeover.
- 2. The BAS shall send occupied and unoccupied cooling/ heating setpoints to the VRF system.
- 3. VRF system points shall be mapped to the BAS. As a minimum:
  - a. Space temperature.
  - b. Heat or cool mode
  - c. Supply temperature.
  - d. Zone scheduling.
  - e. Filter status
  - f. Drain pan overflow.
  - g. Fault

# 2.9 BOILER ROOM GAS DETECTION

- A. Provide carbon monoxide and natural gas detection in the State Side and County boiler rooms, a dual gas detector is specified in Section 230900.
- B. BAS shall generate alarms.
  - 1. 1<sup>st</sup> Alarm Setpoint (low): Level 2 alarm.
  - 2. 2nd Alarm Setpoint (high): Level 1 alarm.

# 2.10 DOMESTIC HOT WATER

A. DHW Temperature Monitoring: Furnish and install a temperature sensor at the domestic hot water supply from the indirect heaters in the County Side Boiler Room and the electric heater in the State Side to monitor temperature.

END OF SECTION 230993

SECTION 232113 – HYDRONIC HVAC PIPING

# PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 23 Section "Common Work Results"
  - 2. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories.
  - 3. Division 23 controls section for temperature-control valves and sensors.

#### 1.2 SUMMARY

A. This Section includes piping and specialties for hydronic HVAC piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping
  - 2. Hydronic specialties
  - 3. Chemical treatment.
- B. Delegated-Design Submittal: Braided Expansion Loops
  - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
  - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

#### 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Qualify soldering processes, procedures, and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.
- C. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- E. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC watertreatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

# 1.7 COORDINATION

- A. Drawings show the general layout of piping and accessories but do not show all required fittings and offsets that may be necessary to connect piping to equipment and to coordinate with other trades. Fabricate piping based on field measurements. Provide all necessary fittings and offsets.
- B. Coordinate layout and installation of hydronic piping and suspension system components with other construction.
- C. Coordinate pipe sleeve installations and penetrations with other trades.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Balancing Valves:
    - a. Griswold Controls.
    - b. ITT Bell & Gossett
    - c. Taco, Inc.
    - d. Tour & Anderson
    - e. IMI Flow Design

- f. Griswold Controls
- g. Watts Industries Inc.
- h. Caleffi
- i. Nexus
- j. Approved equal: Although the above list represents manufacturers we are familiar with, the specifications herein, are not intended to be proprietary or limiting and shall be open to alternate manufacturers provided they meet the intent specified herein.
- 2. Air Vents and Vacuum Breakers:
  - a. Armstrong International, Inc.
  - b. Barnes & Jones, Inc.
  - c. ITT Hoffman
  - d. Caleffi
  - e. Spirotherm
  - f. Spirax Sarco, Inc.
  - g. Approved equal: Although the above list represents manufacturers we are familiar with, the specifications herein, are not intended to be proprietary or limiting and shall be open to alternate manufacturers provided they meet the intent specified herein.

#### 2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

#### 2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. DWV Copper Tubing: ASTM B 306, Type DWV.
- C. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22 or ASME B16.26.
- D. Press Fitting: Viega Pro Press Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect) feature design (leakage path). Provide a smart connect feature to assure leakage of liquids and/or gases from inside the system past the sealing element of an un-pressed connection. The function of this feature shall be to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- E. Wrought-Copper Unions: ASME B16.22.
- F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

# 2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 and Smaller: ASTM A-53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40 and 80, black steel, plain ends.
- B. Steel Pipe, NPS 2-1/2 and larger: ASTM A-53, Type E (electric-resistance welded), Grade B, Schedule 40 and 80, black steel, plain ends.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A-234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings: Material Group: 1.1. End Connections: Butt-welding. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Victaulic or approved equal.
  - 2. Grooved Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron, ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 234, Grade WPB forged steel fittings with grooves or shoulders constructed to accept Victaulic grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 3. Couplings: Ductile-iron housing and synthetic rubber gasket of central cavity pressureresponsive design (Grade "E" EPDM for water services -30°F to 230°F or Grade "EHP" EPDM for water services rated -30°F to 250°F); with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
    - a. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9; Victaulic Style 07 (Zero-Flex®) or Style 107 Quick-Vic® Installation-Ready design.
    - b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 75 or 77.
    - c. Flange Adapters: Ductile iron housing, flat face, for use with grooved end pipe and fittings, for mating directly with ANSI Class 125, 150, and 300 flanges. Victaulic Style 741 or 743.
- I. Mechanically formed copper or steel tee connections are not acceptable.

- J. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ANSI B16.11 may be used for drain, vent and gage connections.
- K. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- L. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

# 2.5 PEX PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. PEX-a manufacturer system warranty shall cover tubing for a duration of 30 years from the date of installation.
  - 1. Uponor Wirsbo hePEX (Basis of Design)
  - 2. Rehau
  - 3. Watts Radiant
  - 4. Viega
- B. Manufacturer's Warranty for Hydronic Piping: Provide a 25 year warranty for PEX-a piping and ASTM F 1960 fittings. Performance Requirements: PEX-a piping and fittings shall meet the following pressure and temperature ratings:
  - 1. 200°F at 80 psi.
  - 2. 180°F at 100 psi.
  - 3. 73.4°F at 160 psi.
- C. Plastic Pipe and Fittings:
  - 1. PEX-a (Engle-method Crosslinked Polyethylene) Piping: Uponor Wirsbo hePEX, ASTM 876 with oxygen-diffusion barrier that meets DIN 4726.
  - 2. PEX-a Fittings, Elbows and Tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
  - 3. UNS No. C69300 Lead-free (LF) Brass.
  - 4. 20 percent glass-filled polysulfone as specified in ASTM D6394.
  - 5. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D6394.
  - 6. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D6394
  - 7. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D6394.
  - 8. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".
- D. Plastic-to-Metal Transition Fittings:
  - 1. Manufacturer: Provide fittings from the same manufacturer of the piping.

- 2. Threaded Brass to PEX-a Transition: One-piece brass fitting with male or female threaded adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring. Typically used for PEX sizes 3 inch and below.
- 3. Brass Sweat to PEX-a Transition: One-piece brass fitting with sweat adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring. Typically used for PEX sizes 3 inch and below.
- 4. Dezincification-resistant (DZR) Brass to PEX-a Transition: Male NPT thread and PEX compression fitting. Editor: Typically used for PEX sizes 1 inch through 4 inch.
- E. Plastic-to-Metal Transition Unions:
  - 1. Manufacturer: Provide unions from the same manufacturer of the piping.
  - 2. Threaded Brass to PEX-a Union: One-piece brass fitting with male or female threaded adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring. Typically used for PEX sizes 3 inch and below.
  - 3. Brass Sweat to PEX-a Union: One-piece brass fitting with sweat adapter and F1960 coldexpansion end, with PEX-a reinforcing cold-expansion ring. Typically used for PEX sizes 3 inch and below.

# 2.6 HYDRONIC VALVES

- A. Ball Valves
  - 1. Threaded Ends 4" and Smaller: 150 psi WP and 600 psi non-shock CWP, forged brass fullport or cast bronze two-piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBV-3C series/B6080 series, Hammond 8501, Nibco T-585-70, Milwaukee BA100, Apollo 70-Series, or approved equal.
  - Soldered Ends 3" and Smaller: 150 psi WP and 600psi non-shock CWP, full-port cast bronze or forged brass two piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBVS-3C series/B6081 series, Hammond 8511, Nibco S-585-70, Milwaukee BA150, Apollo 70-Series, approved or equal.
  - 3. Comply with MSS SP-110.
- B. Butterfly Valves
  - 1. Basis of Design: Center Line Series 200; Lug Type, cast iron, drilled and tapped lug body, ductile iron disc, 416SS shaft, bronze bushing, EPDM seat.
  - 2. Valve bodies shall have extended necks to provide for 2-1/4" insulation as needed.
  - 3. Comply with MSS SP-67.
  - 4. Compatible with ANSI 125/150 flanges. Dead-end capacity to 200 psi.
  - 5. Operators: 6" and smaller: handle with infinite adjustment; 8" and larger: gear w/balancestop hand wheel. Valves located 7 feet or higher: provide gear/chain wheel.
  - 6. Approved Manufacturers: Watts, Hammond, Nibco, Milwaukee, or approved equal.
- C. Bronze Globe Valves, Class 125:
  - 1. Description:

Cumberland County Courthouse AC-1 Replacement and Temperature Controls Upgrades Portland, ME

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron.
- D. Bronze Globe Valves, Class 150:
  - 1. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 300 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    - d. Ends: Threaded.
    - e. Stem: Bronze.
    - f. Disc: Bronze.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron.
- E. Iron Globe Valves, Class 125:
  - 1. Description:
    - a. Standard: MSS SP-85, 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. Packing and Gasket: Asbestos free.
    - g. Operator: Handwheel or chainwheel.
- F. Iron Globe Valves, Class 250:
  - 1. Description:
    - a. Standard: MSS SP-85, Type I.
    - b. CWP Rating: 500 psig.
    - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - d. Ends: Flanged.
    - e. Trim: Bronze.
    - f. Packing and Gasket: Asbestos free.
    - g. Operator: Handwheel or chainwheel.
- G. Wafer Check valves: Provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between two standard Class 125 flanges. Construct iron body valves with pressure containing parts of valves with materials conforming to ANSI/ASTM A 126, Grade B. Support hanger pin by removable side plug; Class 125, cast iron body, stainless steel trim,

bronze disc, Buna-N seal:, Watts BF/DBF series, Metraflex 700 Series, Nibco W920-W, Stockham WG970, Hammond 9253, Milwaukee 1400, or approved or equal.

- H. Swing check valves:
  - Construct pressure containing parts of Valves as follows: Bronze Valves: 125 or 150 psi: ANSI/ASTM B 62; Iron Body Valves: ANSI/ASTM A-126, Grade B. Comply with the following standards for design, workmanship, material and testing: Bronze Valves: MSS SP – 80; Cast Iron Valves: MSS SP – 71.
  - 2. Construct valves of pressure casting free of any impregnating materials. Construct disc and hanger as one piece. Support hanger pins by removable side plug.
  - 3. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB904, Nibco T-413Y, Stockham B320T, Milwaukee 509 or approved equal.
  - 4. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB912, Nibco S-413-Y, Stockham B310T, Milwaukee 511 or approved equal.
  - 5. Flanged Ends 2-1/2" and Larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc: Hammond IR1124, Nibco F918-B, Stockham G931, Milwaukee F2974 or approved equal.
- I. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.
- J. ASME Safety Relief Valves: Bell & Gossett A-434D, or equal; diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV. The fluid shall not discharge into the spring chamber. The valve shall have a low blow-down differential. The valve seat and all moving parts exposed to the fluid shall be of non-ferrous material.

## 2.7 HOOKUPS AND BALANCING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
  - 1. Nexus (Basis of Design)
  - 2. IMI Flow Design
  - 3. HCI
  - 4. Hays
  - 5. Griswold
  - 6. Victaulic
  - 7. Taco
  - 8. Bell & Gossett
  - 9. Approved equal: Although the above list represents manufacturers we are familiar with, the specifications herein, are not intended to be proprietary or limiting and shall be open to alternate manufacturers provided they meet the intent specified herein.
- B. Minimum Requirements Per Coil Installation:

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- 1. Manual Flow Control Valve (MFCV)
- 2. Y-strainer.
- 3. Temperature Control Valve (TCV) see 230900.
- 4. Union connections at coil and TCV.
- 5. Air vent on return side.
- 6. Blowdown/drain valve on supply side.
- 7. Pressure/temperature test plugs across coil and TCV.
- 8. Full port, union end ball valves or butterfly valve for shutoff.
- C. Materials Of Construction  $(2\frac{1}{2})$  and smaller, except as noted)
  - 1. Brass or stainless steel metals.
  - 2. Teflon, EPDM or FKM seals.
- D. Installation
  - 1. Installation shall conform to basic piping methods specifications.
  - 2. All components shall be isolated by shutoff valves.
  - 3. Flexible hoses shall be installed at coil connections as shown in the plans or at the option of the mechanical contractor.
  - 4. Union tailpieces may be used to reduce pipe sizes to match coil and TCV valve sizes.
  - 5. Pressure/Temperature test plugs shall be installed across coil.
  - 6. A Y-strainer or combination strainer and valve shall be installed on the supply side.
  - 7. Unions shall be used to isolate the coil, AFCV and TCV.
- E. Shutoff Valves (2<sup>1</sup>/<sub>2</sub>" and smaller) shall be forged brass ball valves, Nexus Model UX:
  - 1. A one-piece body rated at 250 psi WP, 325° F.
  - 2. Interchangeable union ends with FKM O-ring seal (ground joint is not acceptable).
  - 3. Multiple <sup>1</sup>/<sub>4</sub>" tapped ports for test plugs, vent, and/or drain.
  - 4. Blowout-proof stem with dual KFM O-ring seals.
  - 5. Hard chrome plated stainless steel ball with Teflon seats.
- F. Shutoff Valves (2<sup>1</sup>/<sub>2</sub>" and larger) shall be lug pattern butterfly valves, Nexus Model BV:
  - 1. A minimum of 225 psi WP, 250° F.
  - 2. 125# Class lug pattern cast or ductile iron body.
  - 3. EPDM cartridge seat, 416 stainless steel one-piece shaft, and 304 stainless steel disc.
  - 4. Top and bottom shaft bushings.
  - 5. Provide an infinite position chrome plated steel top plate for balancing purposes.
  - 6. Epoxy coated body.
- G. Manual Flow Control Valves (2<sup>1</sup>/<sub>2</sub>" and smaller) shall be a combination of metering/balance type of forged brass construction, Nexus Model XB:

- 1. A modified venturi equipped with (2) pressure/temperature ports and an ID tag.
- 2. A combination shutoff and memory stop device-indicating degree of opening.
- 3. A rating of 250 WOG, 325°F.
- 4. An interchangeable union ends with FKM O-ring type seal.
- 5. Blowout proof stem with dual FKM O-ring seals.
- 6. Hard chrome plated stainless steel ball with Teflon seats.
- H. Manual Flow Control Valves (2<sup>1</sup>/<sub>2</sub>" and larger) shall be an instrument and metering station with integral Pitot Tube, multiple ports for instruments, accessories and drains, a butterfly throttling valve; Nexus Model NXFB:
  - 1. The Pitot tube shall be twin tube design, of 316 stainless steel with blowout proof attachment to station body.
  - 2. Ports shall include <sup>3</sup>/<sub>4</sub>" port for thermometer well, <sup>1</sup>/<sub>4</sub>" ports for pressure gauge, air vent, transmitter or other accessories, and a <sup>1</sup>/<sub>2</sub>" drain port.
  - 3. The instrument station shall be 125# Class flanged (mates to 150# Class flanges) construction.
  - 4. The butterfly valve shall be lug pattern with a rating 225 PSIG, 250°F. The butterfly valve shall have an infinite position operator with memory stop (6" and smaller), worm gear with memory stop (6" and larger).
- I. Temperature Control Valves, ref. Section 230900 & 230993.
- J. Combination Strainer/Ball Valves (2<sup>1</sup>/<sub>2</sub>" and smaller) used for supply side shutoff and strainer requirements shall be forged brass construction, Nexus Model UY:
  - 1. A minimum rating of 250 WOG, 325° F.
  - 2. Interchangeable union end with FKM O-ring seal.
  - 3. Multiple <sup>1</sup>/<sub>4</sub>" tapped ports for test plugs, vent, or other accessories.
  - 4. Blowout proof stem with dual FKM O-ring seals.
  - 5. Hard chrome plated stainless steel ball with Teflon seats.
  - 6. A 20 mesh 304 stainless steel filter screen, accessible without affecting the valve piping.
  - 7. A port in the filter cap for a blowdown/drain valve.
- K. Combination Strainer/Butterfly Valves (2<sup>1</sup>/<sub>2</sub>" and larger) used for supply side shutoff and strainer requirements shall be cast or gray iron construction, Nexus Model SXFV:
  - 1. A minimum rating of 175 psi WP, 250° F.
  - 2. 125# Class flanges (mates to 150# Class flanges) and lug pattern butterfly valve.
  - 3. Multiple <sup>1</sup>/<sub>4</sub>" tapped accessory ports across the filter screen.
  - 4. A flanged end cap with a  $\frac{3}{4}$ " port for a blowdown/drain valve standard thru 8" size.
  - 5. A  $\frac{3}{4}$ " port for thermometer well.
  - 6. A 304 stainless steel screen, with perforations 0.045" thru 3", and 0.125" thru 8".
- L. Y-Strainers (2<sup>1</sup>/<sub>2</sub>" and smaller) shall be forged brass body, Nexus Model UYX:
  - 1.  $\frac{1}{4}$ " tapped accessory ports.
  - 2. A rating of 250 WOG, 325° F.
  - 3. A 20 mesh 304 stainless steel filter screen, removable without affecting the strainer piping.
  - 4. A port in the filter cap for a blowdown/drain valve.

- M. Y-Strainers (2<sup>1</sup>/<sub>2</sub>" and larger) shall be 125# Class flanged cast or ductile iron body, Nexus Model SXF:
  - 1. Multiple <sup>1</sup>/<sub>4</sub>" tapped accessory ports across the filter screen.
  - 2. A flanged end cap with a  $\frac{3}{4}$ " port for a blowdown valve standard thru 8" size.
  - 3. A  $\frac{3}{4}$ " port for thermometer well.
  - 4. A 304 stainless steel screen, with perforations 0.045" thru 3", and 0.125" thru 8".
- N. Blowdown/Drain Valves shall be forged brass ball valve construction, Nexus Model BD:
  - 1. A minimum rating of 250 WOG, 325° F.
  - 2. Blowout proof stem with dual FKM O-ring seals.
  - 3. Hard chrome plated brass ball with Teflon seats.
  - 4. A  $\frac{3}{4}$  hose end and nylon / brass cap with retainer to protect threads.
- O. Unions (2" and smaller) shall be forged brass, Nexus Model UU:
  - 1. A minimum of 250 psi WP, 325° F.
  - 2. Multiple <sup>1</sup>/<sub>4</sub>" tapped ports for test plugs, vent and/or drain valves.
  - 3. FKM O-ring seal.
- P. Accessories to coil piping components shall conform to the following:
  - 1. Nexus PT Pressure/Temperature test plugs shall be rated for 1000 psi, 325° F, with brass body, Nordel check plugs, and sealed cap.
  - 2. Flexible hoses shall be designed for water, and fire retarding conform to ASTM codes E84-00, with stainless steel outer braid.
  - 3. Hoses ( $\frac{1}{2}$ " thru 1"), Nexus UFHF.
    - a. Shall have a Kevlar reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 400 psi, 248°F.
    - b. Provide dual union or swivel end fittings.
  - 4. Hoses  $(1\frac{1}{4}$ " thru 2"), Nexus UFHM:
    - a. Shall have Rayon reinforced EPDM tube core, brass end fittings, and designed for a working pressure of 300 psi, 248° F. The (2½") hose shall have stainless steel outer braid and carbon steel Sch. 40 fittings, and designed for a working pressure of 400 psi, 70° F.
    - b. Provide least one union or swivel end fitting
  - 5. Nexus MV Manual air vents shall be of brass construction and rated at 250 psi, 450° F.
  - 6. Shaft extensions (2" and smaller) for insulated pipe shall be at least 2<sup>1</sup>/4" tall and constructed of brass
  - 7. Chilled water systems: Provide extended pressure and temperature test plugs, manual air vents and handles. Extended handles shall not break the vapor barrier when operated.
  - 8. Provide a temperature and pressure test/meter kit (Nexus #MKA) for use by MC during start-up, turn-over to Owner at project completion.
# 2.8 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.
- B. Automatic Air Vent: Spirotherm Spirotop, or equal; maintenance-free, designed to vent automatically with float principle; solid-brass body and nonferrous internal parts; 150-psig working pressure; 270°F maximum temperature; NPS 1/2 inlet connection; ½" male thread at vent point for pressure-testing or remote venting of unwanted gases. The Spirotop has a unique "dry" vent design that helps prevent the system fluid from reaching the spring actuated Viton seat and seal assembly, which is the cause of most conventional air vent failures. Air vent shall be dry: release air, not water.
  - 1. The unique valve mechanism is guaranteed not to leak and cannot be shut off.
  - 2. Specially constructed air chamber to protect the valve mechanism from dirt.
  - 3. Sufficient volume to handle pressure fluctuations.
  - 4. A reliable vacuum breaker for system draining.
  - 5. Leak and dirt resistant.
- C. Expansion Tanks: Taco Model CA, or approved equal. Construction: Welded steel, designed, tested and stamped in accordance with ASME (BPV code sec VIII, div 1); supplied with National Board Form U-1, rated for working pressure of (125/150 psi), with flexible heavy duty butyl rubber bladder. Bladder shall be able to accept the full volume of the expansion tank and shall be removable and replaceable. Bladder shall be NSF 61 rated for potable water service and shall be manufactured with FDA approved materials.
- D. Expansion tank isolation valves: Provide valve lockouts: shall meet OSHA requirements to ensure ball valves are locked securely and effectively; for use on 1/4-turn valves to prevent tampering; polypropylene material resists chemicals, solvents, cracking & rust; provide padlock locking mechanism. Seton, Brady, or approved equal.
- E. Air and Dirt Separator
  - 1. Provide air and dirt removal devices of the size and type as shown on the plans. Air and dirt separation devices shall be Taco 4900 Series or approved equal.
  - 2. Air and dirt removal device shall be constructed of steel designed and fabricated per Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code with a maximum working pressure rating of 125 psi at 270°F.
  - 3. Each air & dirt separator shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. Air vent shall be furnished with a closeable port to prevent vent clogging during system fill. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and the removal of floating impurities from the air / system fluid interface within the separator. A blowdown valve shall be provided by the unit manufacturer on the bottom of each air and dirt separator to allow cleaning as required.
  - 4. The air & dirt separator shall employ the use of high surface area, stainless steel pall rings to achieve optimal separation of air & dirt from the system fluid. Screens made of 304-stainless steel are provided on the inlet and outlet of each separator to isolate the internals

from the system. Units installed in open systems shall be provided with a removable top head for removal and cleaning of the internal coalescence media.

- 5. The unit shall be manufactured with a switchable on/off style Neodymium magnet assembly which does not require removal from vessel to facilitate maintenance and cleaning.
- 6. The supplier of the air & dirt separator shall furnish to the design engineer the results of independent air & dirt testing of a representative unit from the suppliers' standard product offering. Suppliers not providing these independent performance test results will not be accepted.
- F. Y-Pattern Strainers: Strainers shall be Y-type with removable basket. Body shall have cast-in arrows to indicate direction of flow. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel. Provide fine-mesh start-up strainers. Strainers in sizes 3-inch and smaller shall have screwed ends; Hammond 3010, or approved equal. Body material shall be cast bronze conforming to ASTM B584-C84400. Strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer screens shall have perforations not to exceed 1/32". In sizes 4 and larger, strainers shall have flanged ends; Hammond 3030, or approved equal. Body material shall be cast iron conforming to ASTM A126 Class B. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Strainer screens shall have perforations not to exceed 1/16" (4" size); 1/8" (5" size and larger).

# 2.9 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Peterson Equipment Co., Inc.
  - 2. Flow Design, Inc.
  - 3. Trerice, H. O. Co.
  - 4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 5. Weiss Instruments, Inc.
- B. Description: "Pete's Plug II", a <sup>1</sup>/<sub>4</sub>" fitting to receive either a temperature or pressure probe 1.8" OD.
- C. Body: Solid brass with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping. Core Inserts: Nordel, an ethylene-propylene based synthetic rubber.
- D. Minimum Pressure and Temperature Rating: 500 PSIG at 275 deg F.

## 2.10 WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Sentinel
  - 2. Anderson Chemical Company.

- 3. Aqua-Chem, Inc.
- 4. Barclay Water Management, Inc.
- 5. General Electric Company; GE Water & Process Technologies.
- 6. H-O-H Water Technology, Inc.
- 7. Metro Group, Inc. (The); Metropolitan Refining Div.
- 8. Nalco; an Ecolab company.
- 9. Watcon, Inc.
- 10. Approved equal: Although the above list represents manufacturers we are familiar with, the specifications herein, are not intended to be proprietary or limiting and shall be open to alternate manufacturers provided they meet the intent specified herein.
- B. Performance Requirements
  - 1. Provide water treatment for closed-loop hydronic systems.
  - 2. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
  - 3. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
  - 4. Closed hydronic systems, including shall have the following water qualities:
    - a. pH: Maintain a value within 8.2 to 9.5.
    - b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
    - c. Total Hardness : <150 ppm as caCO<sub>3.</sub>
    - d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
    - e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
    - f. TSS: Maintain a maximum value of 10 ppm.
    - g. Ammonia: Maintain a maximum value of 20 ppm.
    - h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
    - i. Microbiological Limits:
      - 1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/mL.
      - 2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/mL.
      - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/mL.
      - 4) Sulfate Reducers: Maintain a maximum value of zero organisms/mL.
      - 5) Iron Bacteria: Maintain a maximum value of zero organisms/mL.
- C. Bypass Chemical Feeder: Neptune Model DBF, J. L. Wingert Company, or approved equal.
  - 1. The feeder shell shall be constructed of welded steel construction. The bypass feeder shall be rated at 200 psi and to 200°F. Capacity: 5 gallons minimum.
  - 2. The tank shall have a wide mouth, 3-1/2" opening so that chemical addition can be performed without the need of a funnel. The bypass feeder shall have a continuous threaded closure requiring 2-1/2 turns to close and seal.
  - 3. The cap shall be constructed of cast iron with an epoxy-coated underside to prevent corrosion and shall use a square ring gasket seal.

- 4. Provide a valve package with isolation valves, unions, drain tee, & miscellaneous installation nipples.
- D. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

# 2.11 GLYCOL

- A. General: The project scope shall add propylene glycol to the existing chilled water system to restore the system to 40% solution subsequent to completion of the piping modifications. The contractor shall be responsible for pumping down the existing solution, storing at the site until piping modifications are completed, then re-charging the system subsequent to completion of the piping reevisisions.
- B. DuPont Dowfrost HD or approved equal; the propylene glycol fluid to be used in such a system shall meet the following requirements: The fluid shall be industrially inhibited propylene glycol (phosphate-based). The fluid shall be easily analyzed for glycol concentration and inhibitor level, and easily re-inhibited using inhibitors readily available from the fluid manufacturer. The fluid shall pass ASTM D1384 (less than 0.5 mils penetration per year for all system metals). The fluid shall be dyed bright yellow to aid in leak detection

# PART 3 - EXECUTION

## 3.1 HYDRONIC PIPING APPLICATIONS – ABOVE GROUND

- A. Hot Water, NPS 3 and Smaller: Type L drawn-temper copper tubing with pressed or soldered joints; Schedule 40 steel pipe with threaded joint.
- B. Hot Water, NPS 4 and Larger: Schedule 40 steel pipe with welded or flanged joints.
- C. Chilled Water, NPS 3 and Smaller: Type L drawn-temper copper tubing with pressed or soldered joints.
- D. Chilled Water, NPS 4 and Larger: Schedule 40 steel pipe with welded or flanged joints; or grooved mechanical-joint couplings.

## 3.2 VALVE APPLICATIONS

- A. Hydronic Valve Applications: Shutoff Duty: Ball and butterfly valves. Throttling Duty: Globe, ball, and butterfly valves.
- B. Provide shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line.

- C. Provide calibrated balancing valves in the return water line of terminal units, as indicated, and ass required to facilitate system balancing.
- D. Provide pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

# 3.3 HYDRONIC PIPING INSTALLATIONS

- A. Refer to Division 23 Section "Common Work Results" for installation of:
  - 1. Basic piping requirements.
  - 2. Joint construction requirements.
  - 3. Hanger, support, and anchor devices.
  - 4. Firestopping
  - 5. Sleeves and Escutcheons
  - 6. Dielectric fittings
  - 7. Valves
  - 8. Mechanical Identification
- B. Hydronic piping systems shall be provided to permit the system to be drained. Provide drains, consisting of a tee fitting, NPS 3/4 ball valve, and hose-end fitting with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Provide piping at a uniform grade of 0.2 percent upward in direction of flow. Pipe size at connections to equipment shall be distribution main size, not connection size. Reduce pipe sizes using eccentric reducer fitting installed with level side up. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- D. Provide safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Provide safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements. Check the settings and operation of each safety valve, including valves furnished by heater manufacturer. Record settings.
- E. Swing Connections for Expansion: Connect risers and branch connections to mains with at least five pipe fittings, including tee in main. Connect mains and branch connections to terminal units with flexible hoses at least four pipe fittings, including tee in main.
- F. Terminal Equipment Connections
  - 1. Size for supply and return piping connections shall be same as for equipment connections.
  - 2. Provide control valves in accessible locations close to connected equipment.
  - 3. Arrange piping with offsets to allow for expansion, as well as terminal unit removal.

## 3.4 HYDRONIC SPECIALTIES INSTALLATION

- A. Provide air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- B. Air separator and expansion tank to be provided on the suction side of the system pumps. Expansion tank to be tied into system piping in close proximity to air separator and system fill line. Provide piping to compression tank with a 2 percent upward slope toward tank.
- C. Expansion tanks: Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.

## 3.5 CONTROL VALVE INSTALLATION

- A. Perform the following as directed by the BAS contractor:
  - 1. Provide modulating control valves with minimum of 10 pipe diameters straight pipe at inlet and 5 pipe diameters straight pipe at outlet.
  - 2. Installation of immersion wells and pressure tappings, along with associated shut-off cocks.
  - 3. Installation of flow switches.
  - 4. Setting of automatic control valves or other control devices.
- B. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
- C. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.

## 3.6 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the water characteristics described in Part 2.
- B. Provide bypass chemical feeders in each hydronic system.
  - 1. Provide in upright position with top of funnel not more than 48 inches above the floor.
  - 2. Provide feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
  - 3. Provide NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.
- C. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect

clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Provide temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the commissioning agent.

- D. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water. Circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 6 feet per second. Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.
- E. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.
- F. Close and fill system as soon as possible after final flushing to minimize corrosion. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.
- G. Fill systems that glycol solutions to the concentrations indicated in the equipment schedules.

# 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Provide blinds in flanged joints to isolate equipment.
  - 5. Provide safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:

- 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
- 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
- 3. Isolate expansion tanks and determine that hydronic system is full of water.
- 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
- 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.
  - 2. Inspect pumps for proper rotation.
  - 3. Set makeup pressure-reducing valves for required system pressure.
  - 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Inspect and set operating temperatures of hydronic equipment to specified values.
  - 7. Verify lubrication of motors and bearings.

## END OF SECTION 232113

## SECTION 232123 - HYDRONIC PUMPS

## PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division Section: "Common Work Results"

#### 1.2 SUMMARY

A. This Section includes hydronic pumps and accessories.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
  - 1. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated.
  - 2. Indicate pump's operating point on curves.
  - 3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

#### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

## 1.7 COORDINATION

A. Coordinate electrical power with Division 26.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Grundfos was selected as the basis of design manufacturer. The specifications herein, however, are not intended to be proprietary and shall be open to alternate manufacturers provided they meet the intent specified herein.

## 2.2 GENERAL PUMP REQUIREMENTS

- A. Pump Units: Factory assembled and tested.
- B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve. Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Motors Indicated to be premium efficiency and shall meet or exceed all NEMA Standards Publication MG1 requirements and comply with NEMA premium efficiency levels Class B temperature rise, Class F insulation.
- D. Motors used with VFD's: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Provide AEGIS® Shaft Grounding Ring (SGR) on either DE or NDE of motor to divert current away from the bearings and protect bearings in attached equipment.
  - 2. 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.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

# 2.3 VARIABLE SPEED WET ROTOR CIRCULATOR PUMPS – GRUNDFOS TPE3

- A. Pump shall be a Grundfos TPE3, as scheduled or approved equal; vertical in-line design. Oil lubricated pumps and shaft coupled pumps shall not be accepted. The pump shall be a standard product of a single pump manufacturer. The pump, motor, and variable speed drive shall be an integral product designed and built by the same manufacturer.
- B. The pump shall be certified and listed by a Nationally Recognized Test Laboratory (NRTL) for U.S. and Canada to comply with:
  - 1. UL778
  - 2. UL 60730-1A
  - 3. CAN/CSA No. 108
- C. Ratings
  - 1. Maximum Pressure: 145 PSIG
  - 2. Minimum Media Temperature: 32 °F
  - 3. Maximum Media Temperature 248 °F
  - 4. E. Voltage: [3x440-480V]
- D. Pump Construction
  - 1. Pump housing: Cast Iron: EN-JGL-250
  - 2. Impellers: Composite PES 30% GF
  - 3. Shaft: 316L Stainless Steel
  - 4. Thrust Bearing: Axial: Carbon Graphite, Radial: ceramic Alumina Hilox 961
  - 5. O-Rings: EPDM
  - 6. Bearing Plate: 304 Stainless Steel
  - 7. Control Box: Polycarbonate
  - 8. Rigid Coupler Stainless Steel
  - 9. Seal Carbon-Ceramic (Optional Silicon Carbide)
  - 10. Clamp Ring 304 Stainless Steel
- E. Motor
  - 1. Motor shall be a fan cooled, permanent-magnet synchronous motor tested with the pump as one unit by the same manufacturer with an IE5 efficiency rating. Conventional asynchronous squirrel-cage motors shall not be acceptable.
  - 2. Each motor shall be of the integrated Variable Speed Drive design consisting of a motor and a Variable Frequency Drive (VFD) built and tested as one unit by the same manufacturer.
  - 3. The integrated VFD control shall utilize an energy optimization algorithm to minimize energy consumption by reducing the factory-set set point and adjust to system characteristics. This shall be accomplished without the need of any external sensors or input.
- F. Integral Controller Operating Modes
  - 1. The pump shall have the following control mode and operating modes:

- a. AUTO*ADAPT* During operation, the pump automatically reduces the factory-set setpoint and adjusts it to the actual system characteristic. Manual setting of the setpoint is not possible.
- b. FLOWLIMIT It shall be possible for the user to select a maximum flow that the pump shall not exceed in order to eliminate the need for additional throttling valves. The pump shall operate per selected control mode but will limit speed to not exceed the user specified flow limit
- c. FLOWADAPT The pump shall operate in the AUTOADAPT control mode with FLOWLIMIT enabled.
- d. Proportional Pressure The head delivered shall be reduced from a manual setpoint linearly in accordance with decrease in flow demand in the system
- e. Constant Pressure A manual set, constant head is maintained, irrespective of flow up to the maximum speed of the pump.
- f. Constant Curve The pump runs as an uncontrolled pump by the means of a set of pump curves. The pump curve adjustable between maximum and minimum from the control panel or through a wireless remote control.
- g. Constant Temperature the pump shall adjust speed to maintain a constant media temperature in the flow pipe in which the pump is installed.
- h. Constant Differential Temperature the pump shall adjust speed to maintain a constant temperature drop between the flow pipe in which the pump is installed and a user installed temperature sensor.
- i. Alternating Operation Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. In alternating operation, only one pump shall operating at a time. The operation shall alternate based on time or energy to ensure even run time of both pumps. If a pump stops due to fault the other pump shall take over automatically.
- j. Back-Up Operation Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. In Back-Up operation one pump shall operate continuously. If the duty pumps stops due to fault the back-up pump shall take over automatically.
- k. Cascade Operation Two single head pumps or two heads of a dual head pump shall communicate wirelessly to one another. Two pumps shall operate together in constant pressure control. The pump controller shall determine when to operate a single pump or both pumps to meet demands. While both pumps operate they shall run at the same speed.

- G. Interface and Communication
  - 1. The pump shall have an integrated operator interface consisting of:
    - a. Minimum 2.4" (measured diagonally) color TFT display
    - b. 7 push buttons for navigation of menu
    - c. Push Buttons must be able to operate at minimum 25,000 times

- d. Push Buttons must be isolated from the main supply by reinforced insulation according to UL60730
- e. LEDs to signal pump status for quick indication
- 2. The pump shall have a sensor integrated directly into the pump housing with 4 lines consisting of Ground, Supply, and two signals for Differential Pressure and Media Temperature.
  - a. Sensor Supply shall be 4.8V DC +/- 2% at 20mA referenced to Ground. The supply must be able to withstand a permanent short circuit.
  - b. The electrical values for the signal shall be 4.8V DC + 2% referenced to ground.
- 3. The pump module shall have one analog input configurable for either 4-20mA or 0-10VDC input signal configurable for external Temperature or Pressure sensor, or Setpoint influence. Sensor input shall have three wires for Ground, Supply, and Signal. The Supply for external analog input shall be 24V DC +/-10% at 22mA reference to Ground. The supply must be able to withstand a permanent short circuit. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
- 4. The pump shall have 3 Digital Inputs galvanically isolated from the main supply by a reinforced insulation according to UL60730.
  - a. Start/Stop –Used to start or start the pump. The pump shall be enabled when connected to common ground by an external potential free short circuit. An open circuit to this input shall disable the pump. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
  - b. Minimum used to force the pump to run at minimum load (curve). When connected to common ground by an external potential free short circuit the pump must run at minimum load. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
  - c. Maximum used to force the pump to run at maximum load (curve). When connected to common ground by an external potential free short circuit the pump must run at maximum load. Connection can be made to a screw terminal capable of wire sizes up to AWG16.
- 5. The pump module shall have two Output Relays. Each relay shall be configurable for Alarm, Reading, or Operating indication. Each relay must have three screw terminals see above. Output relays contacts shall be rated for maximum 250VAC at 2A and minimum 5VDC at 20mA. Each must have galvanic isolation from the internal supply by reinforced insulation according to UL60730.
- 6. Shall be capable of accepting an optional add-on module for integration into Building Management Systems:
  - a. LonWorks
  - b. Bacnet IP or MSTPModbus
  - c. Profibus

## 2.4 PUMP SPECIALTY FITTINGS

Cumberland County Courthouse AC-1 Replacement and Temperature Controls Upgrades Portland, ME

A. Pumps with ECM/VFD shall have a check valve and shutoff valve instead of the multi-purpose valve.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine equipment foundations for compliance with requirements for installation. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PUMP INSTALLATION

- A. Pumps and equipment shall be provided per manufacturer's recommendations and according to the standards of the Hydraulics Institute.
- B. Provide pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.
- C. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings. If necessary to meet this requirement, provide additional pipe supports and flex connectors.
- D. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow and to avoid air pockets.
- E. Provide connector/expansion joints at the pump suction and discharge as indicated.
- F. Pumps shall **NOT** be run dry to check rotation.
- G. In-line Pumps: Provide in-line pumps with continuous-thread hanger rods and elastomeric hangers of size required to support weight of in-line pumps.

#### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Provide valves that are the same size as piping connected to pumps.
- D. Provide suction and discharge pipe sizes equal to or greater than diameter of pump nozzles. Provide fittings and specialties as detailed on the plans.
- E. Provide a single gage with three-input selector valve; locate at pump suction and discharge tappings, also strainer.

F. Connect wiring and provide grounding in accordance with Division 26. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1. Install control and electrical power wiring to field-mounted control devices.

# 3.4 COMMISSIONING

- A. Verify that pumps are installed and connected according to the Contract Documents. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents. Complete installation and startup-checks according to manufacturer's written instructions.
- B. Provide start-up of the pumping systems. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.
- C. Check piping connections for tightness.
- D. Clean strainers on suction piping.
- E. Perform the following startup checks for each pump before starting:
  - 1. Verify bearing lubrication.
  - 2. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
  - 3. Verify that pump is rotating in the correct direction.
- F. Prime pump by opening suction valves and closing drains, prepare pump for operation. Start motor. Open discharge valve slowly.
- G. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

## 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
  - 2. Review data in maintenance manuals.

## END OF SECTION 232123

# SECTION 233113 - DUCTWORK

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 8 for Access Doors
  - 2. Division 23 Section "Common Work Results"
  - 3. Division 23 Section "Air Terminals"
  - 4. Division 23 Control Section
  - 5. Division 23 Section "Testing, Adjusting, and Balancing".

## 1.2 SUMMARY

A. This Section includes ductwork and accessories.

#### 1.3 SYSTEM DESCRIPTION

- A. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide necessary fittings and offsets. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions, which may be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
- B. The contractor must comply with the enclosed specification in its entirety. If on inspections, the engineer finds changes have been made without prior written approval, the contractor will make the applicable changes to comply with this specification, at the contractor's expense.
- C. At the discretion of the engineer, sheet metal gauges, and reinforcing may be randomly checked to verify duct construction is in compliance.

#### 1.4 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. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1. Exception: Sheet metal surfaces and fasteners.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
- 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. Fittings.
  - 4. Reinforcement and spacing.
  - 5. Seam and joint construction.
  - 6. Penetrations through fire-rated and other partitions.
  - 7. Equipment installation based on equipment being used on Project.
  - 8. Hangers and supports, including methods for duct and building attachment.
- C. Delegated-Design Submittal:
  - 1. Sheet metal thicknesses.
  - 2. Joint and seam construction and sealing.
  - 3. Reinforcement details and spacing.
  - 4. Materials, fabrication, assembly, and spacing of hangers and supports.
- D. Ductwork Specialties Product Data; provide for the following:
  - 1. Sealant
  - 2. Duct-mounted access doors and panels.
  - 3. Flexible ducts.
  - 4. Backdraft dampers.
  - 5. Manual-volume dampers: Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval.
  - 6. Louvers: Provide data describing design characteristics, maximum recommended air velocity, design free area, AMCA seals, materials and finishes. Provide independent agency reports showing compliance with specified performance criteria. For units with factory-applied color finishes, provide color chart.

#### 1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
- 2. Suspended ceiling components.
- 3. Structural members to which duct will be attached.
- 4. Size and location of initial access modules for acoustical tile.
- 5. Penetrations of smoke barriers and fire-rated construction.
- 6. Items penetrating finished ceiling examples: lighting fixtures, sprinklers, etc.
- 7. Areas of building where coordination drawings are required:
  - a. All Mechanical Rooms
  - b. All ductwork 24" wide and larger.
  - c. Congested areas
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

#### 1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### 1.8 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- C. National Fire Protection Association (NFPA)
  - 1. 90A: Standard for the Installation of Air Conditioning and Ventilating Systems
  - 2. 96: Ventilation Control and Fire Protection of Commercial Cooking Operations
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. 3rd Edition: 2005 HVAC Duct Construction Standards, Metal and Flexible
  - 2. 1st Edition: 2012 ANSI/SMACNA 016-2012 HVAC Air Duct Leakage Test Manual

June 21, 2024

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and fire stopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Deliver, store and handle materials according to manufacturer's written recommendations.
- C. All ductwork, equipment, and fittings delivered and stored on the job site must be capped to prevent the entry of moisture, construction dust or other debris.

#### PART 2 - PRODUCTS

## 2.1 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA 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. Galvanized Coating Designation: G60 or G90 as indicated. 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 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.
- 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.

#### 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.

- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of un-braced panel area, unless ducts are lined. All large ducts must be braced as required to prevent drumming.
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
  - 1. Fig. 2-3 Rectangular Elbows: Type RE2 square throat with vanes, Type RE1 radius (1.5W minimum), or Type RE5 dual radius. Square throat is not allowed.
  - 2. Vane support in elbows: Fig 2-4. Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Mounting rails shall have friction insert tabs that align the vanes automatically. Tab spacing shall be as specified in Figure 2-3 of SMACNA Rail systems with non-standard tab spacing shall not be accepted. Due to tensile loading, vanes shall be capable of supporting 250 pounds when secured according to the manufacturer's instructions.
  - 3. Fig. 2-5 Rectangular Divided Flow Branches: Type 1, Type 2, Type 4A, or 4B.
  - 4. Fig. 2-6 Branch Connections: 45-degree entry, 45-degree lead-in, bell-mouth or spin-in (single diffuser supply only).
  - 5. Fig. 2-7 Offsets and Transitions. Use gradual offsets as shown, 90-degree offsets shall be avoided.
  - 6. Fig 2-9 Duct Coils: Duct coils with transitions and upstream access door as shown.

## 2.3 ROUND DUCT FABRICATION

- A. Fabricate supply ducts of galvanized steel according to SMACNA.
- B. Longitudinal Seams: Select seam types and fabricate according to SMACNA Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.
  - 1. Exposed Round Ducts: Shall be Spiral Seam (RL-1 seam) at 2-inch wg construction.
  - 2. Concealed Round Ducts: Shall be longitudinal Grooved Seam Flat lock (RL-5 seam) at 2-inch wg construction.
  - 3. Snap lock seams shall not be used for this project.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA.

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#### 2.4 HANGERS AND SUPPORTS

- A. Hanger Rods: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Outdoor 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 Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A-603. 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.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. 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.
- G. Supports For Roof Mounted Items:
  - 1. Equipment rails shall be galvanized steel, minimum 18-gauge, with integral baseplate, continuous welded corner seams, factory installed 2x4 treated wood nailer, 18-gauge galvanized steel counter flashing cap with screws, built-in cant-strip; minimum height 11 inches. Provide raised cant strip to start at the upper surface of the insulation.
  - 2. Roof Duct Supports: Portable Pipe Hanger Model number PPH-D Enclosed style.
    - a. Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without causing damage to the roofing membrane.
    - b. Hot dip galvanize in accordance with ASTM A 123 after fabrication.
    - c. Factory fabricated to support exact duct sizes and equipment to be installed.
    - d. Provide SS or galvanized clamps, bolts, nuts, washers, and other devices as required for a complete system.

## 2.5 SEALANT MATERIALS

A. Joint Sealant/Mastic: Shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air and moisture into the duct system. Sealer shall be UL 723 listed; UL 181A-M or 181B-M listed; and meet NFPA 90A requirements. Pressure sensitive tape shall not be used as a sealing mechanism.

- 1. Maximum 5 flame spread and 0 smoke-developed (ASTM E-84 Tunnel Test).
- 2. Generally, provide liquid sealant for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger.
- 3. Resistance to mold, mildew and water: Excellent
- 4. Color: Gray
- 5. Duct sealant/mastic shall meet requirements for LEED. ITW TACC Miracle Kingco water-based sealants, or approved equal.
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- C. Round Duct Joint O-Ring Seals: Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch w.g. and shall be rated for 10-inch w.g. static-pressure class, positive or negative. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

#### 2.6 FITTINGS

- A. Tees, Laterals, and Conical Tees: Use 45 degree; fabricate to comply with SMACNA with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- C. Elbows: Diameters 3 through 8 inches shall be two-section die stamped; all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
- D. Low-point drains: Ductmate moisture drain with funnel collection design; <sup>3</sup>/<sub>4</sub>" connection with drain fitting and cap.

#### 2.7 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Greenheck Fan Corporation.
  - 3. McGill Air Flow LLC.
  - 4. Nailor Industries Inc.
  - 5. Durodyne
  - 6. Cesco
  - 7. Buckley
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels Round Duct."

- 1. Door: Double wall, rated for up to 4.5" static pressure. Door panel filled with 1" fiberglass insulation; <sup>3</sup>/<sub>4</sub> lb. density. Hinges and Latches: 1-by-1-inch continuous piano hinge and cam latches. Fabricate doors airtight and suitable for duct pressure class.
- 2. Frame: Galvanized sheet steel, with bend-over tabs.
- 3. Provide 1/8" thick neoprene gaskets.
- 4. Locks: Access doors less than 12 sq. inches: One cam lock. Doors over 12 sq. inches shall have two locks.

# 2.8 FLEXIBLE CONNECTORS

- A. Provide for all air moving equipment. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with NFPA 90A. Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts. Duro-Dyne, Ductmate, Hardcast, or approved equal.
- B. Indoor Flexible Connector Fabric: Glass fabric double coated with polychloroprene or neoprene. Minimum Weight: 26 oz. /sq. yd. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- C. Outdoor Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber or hypalon, white color; weatherproof coating resistant to the sun's ultraviolet rays and ozone environment. Minimum Weight: 24 oz. /sq. yd. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

## 2.9 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 0 0r 1. Flame Spread: Less than 25; Smoke Developed: Less than 50.
- B. All products shall be certified by Greenguard Environmental Institute; independent testing of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Greenguard provides independent, third-party certification of IAQ performance. Certification is based upon criteria used by EPA, OSHA and WHO.
- C. Rated Positive Pressure: 10" w.g. per UL-181. Maximum negative pressure: <sup>3</sup>/<sub>4</sub>".
- D. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing glassfiber insulation around a continuous inner liner.
  - 1. R6 insulation, Basis of Design: Atco #86
  - 2. Reinforcement: Steel-wire helix encapsulated in inner liner.
  - 3. Jacket (inner and outer): Polyethylene film.
- E. Exhaust/Return Flexible Ducts, not insulated: Atco#50 Factory-fabricated, round duct. Reinforcement: Triple lamination of tough metallized polyester, aluminum foil and polyester encapsulates a steel wire helix. Rated for <sup>3</sup>/<sub>4</sub>" w.g. negative pressure.

- F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a wormgear action, in sizes 3 to 18 inches to suit duct size.
- G. Hangers shall be band type, 1" wide minimum.

#### 2.10 MANUAL-VOLUME DAMPERS

- A. Manual balancing dampers meeting the following specifications shall be furnished and installed on all branch ducts and where shown on plans. Testing and ratings to be in accordance with AMCA Standard 500-D.
- B. Single-Blade Rectangular Dampers shall consist of: an 18 ga. galvanized steel frame with 3-1/2 in. depth; blades fabricated from 20 ga. galvanized steel; integral 1/2 in. diameter axles. Damper suitable for pressures to 1.0 in. wg, velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBD-10.
- C. Multi-Blade Rectangular Dampers shall consist of: a 16 ga. galvanized steel hat channel frame with 5 in. depth; triple V type blades fabricated from 16 ga. galvanized steel; ½ in. dia. plated steel axles; external (out of the airstream) blade-to-blade linkage. Damper suitable for pressures to 4.0 in. w.g. (996 Pa), velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBD15.
- D. Round dampers shall consist of: a 20 ga. galvanized steel frame with 6 in. depth; blades fabricated from 20 ga. galvanized steel; 3/8 in. square plated steel axles turning in acetal bearings. Damper suitable for pressures to 1.0 in. wg, velocities to 2000 fpm and temperatures to 180°F. Basis of design is Greenheck model MBDR50.

#### 2.11 LOUVERS

- A. Manufacturers: American Warming and Ventilating, Inc. was selected as the basis of design manufacturer. The specifications herein, however, are not intended to be proprietary and shall be open to alternate manufacturers provided they meet the intent specified herein.
- B. Louvers shall be AMCA Licensed. Louvers shall comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- C. Louvers shall be AMCA Certified in accordance with AMCA 511.
- D. Intake Louvers: Water penetration tested in accordance with AMCA 500-L.
- E. Greenheck EVH-501D, 5-inch frame depth, vertical blades, 54% free area, Miami-Dade Notice of Acceptance and Florida Building Code Approved, AMCA 500-L Certified - Air Performance, Water Penetration and Wind Driven Rain. AMCA 540 and 550 Listed.
- F. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels

surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch. Primer: Zinc chromate, alkyd type.

- G. Accessories
  - 1. Insulated Blank-Off Panels: 0.040 aluminum sheet, 2 inches thick, aluminum skin insulated core, factory installed with removable fasteners and neoprene gaskets.
  - 2. Aluminum Insect Screen 18-16 mesh, mill finish, .011-inch wire.
  - 3. Bird Screen: aluminum, 5/8" mesh, removable frame, re-wireable.
  - 4. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

#### PART 3 - EXECUTION

#### 3.1 DUCT INSTALLATION, GENERAL

- A. Provide volume dampers at branch ducts to RGD's. If volume dampers are inadvertently not shown, contractor shall provide, the intent is to provide volume dampers at branches.
- B. Provide ducts and accessories according to SMACNA unless otherwise indicated.
- C. Construct and install each duct system for the specific duct pressure classification indicated.
- D. Properly seam, brace, stiffen, support and render ducts mechanically airtight. Adjust ducts to suit job conditions. Dimensions may be changed as approved, if cross sectional area is maintained.
- E. Provide ducts in lengths not less than 12 feet, unless interrupted by fittings. Provide ducts with fewest possible joints.
- F. Provide fabricated fittings for changes in directions, changes in size and shape, and connections.
- G. Provide couplings tight to duct wall surface with a minimum of projections into duct.
- H. Provide ductwork to allow maximum headroom. Provide ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Provide ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Provide ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Exterior ductwork shall have a pitch of at least 3 degrees on the top, to allow water runoff, prevent ice buildup.

#### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Hangers Exposed to View: Threaded rod and angle or channel supports.
- C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system. Seal duct joints to prevent dirt marks.
- D. 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.
- E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- F. Repair or replace damaged sections and finished work that does not comply with these requirements.

#### 3.3 MATERIALS

- A. Hangers, accessories, and dampers shall be same material as parent duct.
- B. Ducts shall be G60 galvanized steel except as follows:
  - 1. Un-insulated exterior ductwork: G90 galvanized steel.
  - 2. Exterior ductwork: Hangers and attachments shall be electro-galvanized, all-thread rod or galvanized rods with threads painted after installation. Refer to SMACNA Fig. 5-3. Ductwork shall be pitched or sloped to prevent "ponding" of water.
  - 3. Swimming Pool (natatorium) ductwork: Aluminum, water-tight.
  - 4. Plenums at outside louvers: G90 galvanized steel; horizontal ducts connected to louver shall be water-tight and pitch to drain into the louver plenum. Louver plenum shall be water-tight, pitched to drain to exterior. Provide low-point drain fittings at low points.
  - 5. Locker Room Shower area exhaust ductwork: Aluminum
  - 6. Radon exhaust: See 221216.
- C. Painted Exposed Ducts
  - 1. Painting shall be by Division 09.

#### 3.4 DUCT CLASSIFICATIONS AND SEALING

- A. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
  - 1. Supply duct upstream of VAV terminal units: 6 in. w.g.
  - 2. Supply Ducts downstream of VAV terminal units: 2-inch w.g.
  - 3. Return Ducts: 4-inch w.g, negative pressure.
- B. Seam And Joint Sealing:
  - 1. Ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage.
  - 2. Pressure-sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory, and the tape is used in accordance with that certification.
  - 3. Connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required.
  - 4. Spiral lock seams need not be sealed.
  - 5. Seal externally insulated ducts before insulation installation.

#### 3.5 DUCT PENETRATIONS

- A. Fire or Smoke Rated Penetrations not requiring a fire and/or smoke damper: Where ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and fire dampers are not required, the opening in the construction around the duct shall be provided in accordance with the UL listing of the penetration. Provide firestopping per Section 230500.
- B. Fire or Smoke Rated Penetrations: Provide fire and/or smoke damper.
- C. Non-Fire-Rated Exposed Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- D. Non-Fire-Rated Concealed Penetrations: Provide insulation infill and acoustical sealant around gaps. Tightly seal to prevent sound transmission. Neatly finish.
- E. Mechanical room floor penetrations: Provide 4-inch high concrete curbs or other sealing method to prevent leakage from mechanical room into floor penetration.
- F. Flexible air ducts or connectors shall not pass through any wall, floor, or ceiling.

#### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA Chapter 5, "Hangers and Supports."
- B. Building Attachments: Comply with SMACNA Chapter 5, "Hangers and Supports". Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

- C. Hanger Spacing: Comply with SMACNA Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. 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.
- E. Provide upper attachments to structures. Select and size upper attachments with pull-out, tension,

## 3.7 FLEXIBLE DUCT

- A. Provide in accordance with manufacturer's and SMACNA recommendations.
- B. Flexible ducts hall be supported at manufacturer's recommended intervals, but at no greater distance than 5 feet. Maximum permissible sag is <sup>1</sup>/<sub>2</sub>" per foot of spacing between supports.
- C. Provide duct fully extended; do not install in the compressed state or use excess lengths.
- D. Avoid bending ducts across sharp corners or incidental contact with metal fixtures, pipes, conduits, or hot equipment.
- E. Bends shall be made with not less than 1 duct diameter centerline radius. Ducts shall extend a few inches beyond the end of a sheet metal connection before bending.
- F. Hanger or saddle material in contact with the duct shall be at least 1" wide.
- G. Provide at least 2 duct diameters of straight duct at the entrance to register, grilles, and diffusers.

## 3.8 DUCT ACCESSORIES INSTALLATION

- A. Provide duct accessories according to applicable details shown in SMACNA.
- B. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards
- C. Each register, grille, or diffuser shall have a means of air flow adjustment. Provide volume damper in branch duct if not furnished with the RGD.
- D. Adjust operable devices for proper action.
- E. Manual dampers shall be visible outside the insulation and marked with a 12" orange ribbon.
- F. Locate each duct smoke detector in a serviceable location, in accordance with its listing.

- G. Perform the following as directed by the controls contractor: Installation of control devices. Access doors where indicated and as required.
- H. Provide duct access panels for access components that require servicing.
  - 1. Provide duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining per equipment manufacturers' requirements.
  - 2. Provide access panels on side of duct where adequate clearance is available.
  - 3. Locate panel upstream and/or downstream as recommended by manufacturer.
  - 4. Locations:
    - a. Upstream side of duct coils.
    - b. At outdoor-air intakes.
    - c. Adjacent to and close enough to life safety dampers, to reset or reinstall fusible links.
    - d. Control devices requiring inspection.
    - e. Elsewhere as indicated or required by duct accessory manufacturer
  - 5. Inspect locations of access doors and verify that purpose of access door can be performed.
- I. Control Damper Installation
  - 1. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
  - 2. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure <sup>1</sup>/<sub>4</sub> in. larger than damper dimensions and shall be square, straight, and level.
  - 3. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 1/8 in. of each other.
  - 4. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
  - 5. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, sections must open and close simultaneously.
  - 6. Provide a visible and accessible indication of damper position on the drive shaft end.
  - 7. Support ductwork in area of damper when required to prevent sagging due to damper weight.
  - 8. After installation of low-leakage dampers with seals, caulk between frame and duct opening to prevent leakage around perimeter of damper.

## 3.9 LOUVER INSTALLATION

A. Louvers to be furnished by Division 23; mounted and installed by the contractor responsible for the outside wall construction. Ductwork shall be connected to the louvers by Division 23.

- B. Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. For new construction, or where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- C. Installation
  - 1. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
  - 2. Pitch horizontal ducts and plenums connected to louvers downward toward louvers not less than 1 inch in 10 feet. Connect to louver to allow drainage to exterior. Seal ducts water-tight.
  - 3. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.
  - 4. Form closely fitted joints with exposed connections accurately located and secured.
  - 5. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
  - 6. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
  - 7. Provide concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather tight louver joints are required.
- D. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

## 3.10 PROTECTION

- A. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
  - 1. The HVAC system and ductwork shall be provided with protective coverings. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire duct from the points where the air enters the system to the points where the air is discharged from the system.
  - 2. The duct system shall be free of construction debris.
  - 3. The working area shall be clean, dry and the ductwork protected from dust.
  - 4. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.

- B. Upon completion of installation duct systems and before HVAC system start-up, visually inspect the ductwork proper installation
- C. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork. Turn the HVAC system on and allow it to run until steady state operation is reached. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.

## 3.11 FIELD QUALITY CONTROL

- A. Duct Leakage Tests
  - 1. Ductwork that is designed to operate at static pressures in excess of 3 in. of water and ductwork located outdoors shall be leak-tested according SMACNA Duct Leakage Test Procedures.
  - 2. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. All sections shall be selected by the building owner or the designated representative of the building owner. Positive pressure leakage testing is acceptable for negative pressure ductwork.
  - 3. The maximum permitted duct leakage shall be:

$$L_{max} = C_I P^{0.65}$$

where

- $L_{max}$  = maximum permitted leakage, cfm per 100 ft<sup>2</sup> of duct surface area
- $C_L$  = 4, duct leakage class, cfm per 100 ft<sup>2</sup> of duct surface area per in. of water<sup>0.65</sup>

P = test pressure, which shall be equal to the design duct pressure class rating, in. of water

- 4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- 5. Test for leaks before applying external insulation.
- 6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- 7. Give seven days' advance notice for testing.
- 8. Submit a test report for each test. Documentation shall be provided demonstrating that representative sections totaling at least 25% of the duct area have been tested and that all tested sections comply
- 9. Duct system will be considered defective if it does not pass tests and inspections.

## 3.12 DUCT CLEANING

A. Ducts shall be kept clean. If the contractor fails to maintain cleanliness, duct cleaning will be required, using duct cleaning methodology as indicated in NADCA ACR.

June 21, 2024

END OF SECTION 233113

SECTION 233600 - AIR TERMINAL UNITS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 23 Section "Common Work Results"
  - 2. Division 23 Controls Section for control devices installed on air terminals.

#### 1.2 SUMMARY

A. This Section includes single-duct air terminals.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of air terminal unit.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for air terminal units.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 3. Documentation indicating that units comply with ASHRAE 62.1, Section 5 "Systems and Equipment."
  - 4. For adhesives and sealants, documentation including printed statement of VOC content.

## 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate requirements of air terminals and are based on specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. Listing and Labeling: Provide electrically operated air terminals specified in this Section that are listed and labeled. The Terms "Listed" and "Labeled": As defined in NFPA 70,

Article 100. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

- C. Testing Requirements: Test and rate air terminals according to ARI 880, "Industry Standard for Air Terminals."
- D. Identification: Label each air terminal with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.
- E. NFPA Compliance: Provide air terminals according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- F. Comply with NFPA 70 for electrical components and installation.
- G. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Trane was selected as the basis of design manufacturer. The specifications herein, however, are not intended to be proprietary and shall be open to alternate manufacturers provided they meet the intent specified herein.

## 2.2 SINGLE-DUCT AIR TERMINALS

- A. The unit casing shall be comprised of 22 gauge galvanized steel. Outlet connection shall be slip and drive. Basis of Design: Trane VariTrane Single-Duct VCCF – Cooling Only or Trane VCWF – With Hot Water Coil.
- B. Terminal units shall be ARI 880 98 certified and UL Listed.
- C. Casings: 22 gauge galvanized steel. Maximum casing leakage: 1.5 cfm at 1-inch w.g. inlet static pressure, certified ultra-low air leakage.
- D. 1" Double-wall Insulation—Interior surface of unit casing is acoustically and thermally lined with a 1-inch, 1.0 lb./ft3 composite density glass fiber with high-density facing. Insulation Rvalue is 3.85. Insulation is UL listed and meets NFPA-90A and UL 181 standards. Insulation is covered by interior liner made of 26-gage galvanized steel. All wire penetrations are covered by grommets. There are no exposed edges of insulation (complete metal encapsulation).
- E. The air inlet connection shall be an 18 gauge galvanized steel cylinder sized to fit standard round duct. A multiple point, averaging flow sensing ring shall be provided with balancing taps for measuring within +/- 5% of unit cataloged airflow. Airflow versus pressure differential calibration chart shall be provided. The damper blade shall be constructed of a closed cell foam seal mechanically locked between two 22 gauge galvanized steel disks. The damper blade assembly shall be connected to a cast zinc shaft supported by self-lubricating bearings. The

shaft shall be cast with a damper position indicator. The valve assembly shall include a mechanical stop to prevent over stroking. At 4.0" w.g. air valve leakage shall not exceed 1% of cataloged airflow.

- F. Hot Water Coil (where scheduled): Factory mounted on outlet. Provide full fin collars provided for accurate fin spacing and maximum fin-tube contact. The seamless copper tubes shall be mechanically expanded into the fin collars. Coils shall be proof tested at 450-psi and leak tested at 300-psi air pressure under water. Coil connections shall be sweat with left hand or right hand coil connections as per field constraints.
- G. Heating coils shall be provided with an access for cleaning. Provide access panels large enough for inspection, adjustment, and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
- H. Controls: The terminals will have pressure independent direct digital controls supplied and mounted by the control contractor. Terminals shall be furnished with a pneumatic inlet velocity sensor. The sensor shall be multi-point center averaging type, with a minimum of four measuring ports parallel to the take-off point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03" wg at an inlet velocity of 500 fpm. Flow measuring taps and flow curves shall be supplied with each terminal for field balancing airflow. All pneumatic tubing shall be UL listed fire retardant (FR) type.
- I. Each terminal shall be equipped with labeling showing unit location, size, and scheduled cfm.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Provide air terminals level and plumb, according to manufacturer's written instructions, roughin drawings, original design, and referenced standards.
- B. Allow adequate clearance to meet NEC on control box side of unit to meet NEC.
- C. Support in accordance with SMACNA and manufacturer recommendations.
- D. Connect ductwork to air terminals according to Division 23 ductwork Sections. Slip each inlet duct over the inlet collar of the terminal. Fasten and seal the connection airtight. The diameter of the inlet duct must be equal to the listed size of the terminal.
- E. Inlet and outlet duct must be installed in accordance with SMACNA guidelines. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls. Provide a minimum of 2.5 equivalent duct diameters of straight duct at the inlet.

## 3.2 CONNECTIONS

- A. Provide piping adjacent to air terminals to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, and union; and to return with control valve, balancing valve and union.

## 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## 3.4 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
  - 3. Verify that controls and control enclosure are accessible.
  - 4. Verify that control connections are complete.
  - 5. Verify that nameplate and identification tag are visible.
  - 6. Verify that controls respond to inputs as specified.

## 3.5 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.
Issued For Construction June 21, 2024

END OF SECTION 233600

### SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 23 Section "Common Work Results"
  - 2. Division 23 Section "Ductwork"
  - 3. Division 23 Section "Testing, Adjusting, and Balancing"

#### 1.2 SUMMARY

A. This Section includes diffusers, registers (combination grille & damper), and grilles.

#### 1.3 SUBMITTALS

- A. Each manufacturer shall check noise level ratings for registers and diffusers to insure that the sizes selected will not produce noise to exceed 30 db, "A" scale, measured at occupant level; notify Owner's representative of problems prior to shop drawing submittal.
- B. Pressure drop, airflow and noise criteria selection are based on design equipment. Manufacturers not submitting design makes must provide written certification in front of submittal that equipment submitted has been checked against and performs equal to the design make.
- C. Product Data: For each model indicated, include the following:
  - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
  - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
  - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
  - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
- D. Coordinate locations with reflected ceiling plans and wall elevations as applicable.
- E. Coordinate mounting frame with associated mounting surface.

#### 1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A.
- B. Sound pressure levels shall be determined by using AHRI Standard 885-2008 "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Outlets".
- C. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Diffusers, registers, and grilles are scheduled on Drawings.
- B. Border and mounting type shall match the mounting surface. Coordinate with mounting conditions.
- C. Material shall match the specified ductwork. Coordinate with Section 233113 "Ductwork".
- D. Provide with a White Powder Coat finish, unless noted otherwise.
- E. Grille blade orientation: Vertical rectangle (wall grille with height longer than width): The blades shall run parallel to the short dimension of the grille. Horizontal rectangle: The blades shall run parallel to the long dimension of the grille.

#### 2.2 MANUFACTURERS

A. Manufacturers: Price was selected as the basis of design manufacturer. The specifications herein, however, are not intended to be proprietary and shall be open to alternate manufacturers provided they meet the intent specified herein.

#### 2.3 SUPPLY

- A. Modular Louvered Face Diffusers
  - 1. Material: steel (Price Model SMDA)
  - 2. Air pattern shall be 1-way, 2-way, 3-way, or 4-way as scheduled.
  - 3. Outer frame assembly, which facilitates mounting.
  - 4. Integral collar that allows connection to the square or rectangular duct. Provide a square to round adaptor as scheduled.
  - 5. Inner core assembly consisting of fixed louvers capable of producing the airflow discharge pattern as indicated on the project plans and shall be fully removable from the installed diffuser frame for access to any dampers or other ductwork components located in or near the diffuser neck.

- 6. The inner core assemblies shall be identically constructed so that directional core assemblies providing different airflow discharge patterns may be interchanged between frames if the frame duct connections are the same size.
- 7. The diffuser shall be supplied with a set of pattern deflectors to allow field adjustment of the air pattern from horizontal to vertical airflow.
- 8. The diffuser shall be supplied with an aperture style volume flow damper. The damper shall be manually adjustable from the diffuser face.

### PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Provide diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- C. Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practicable.
  - 1. For units installed in lay-in ceiling panels, locate units in the center of the panel.
  - 2. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Provide diffusers, registers, and grilles with airtight connection to ducts.
- E. Provide 18" minimum of vertical straight ductwork at the entrance to ceiling diffusers.
- F. Plenum boxes on grilles/registers shall be 8" minimum height.

# 3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- B. Adjustable outlets: adjust pattern for draft-free air distribution.

### 3.3 CLEANING

A. Protect unit interiors from moisture, construction debris and dust, and other foreign materials. Comply with Section 233113 "Ductwork" Paragraph: Field Quality Control. B. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 233713

## SECTION 237314 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division Section: "Common Work Results"

#### 1.2 SUMMARY

- A. Section includes
  - 1. Outdoor Air Handlers

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.
- B. Unit sound performance data shall be provided using AHRI Standard 260 test methods and reported as sound power. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each air-handling unit.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 3. Include unit dimensions and weight.
  - 4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
  - 5. Fans:
    - a. Include certified fan-performance curves with system operating conditions indicated.

- b. Include certified fan-sound power ratings.
- c. Include fan construction and accessories.
- d. Include motor ratings, electrical characteristics, and motor accessories.
- 6. Include certified coil-performance ratings with system operating conditions indicated.
- 7. Include filters with performance characteristics.
- 8. Include dampers, including housings, linkages, and operators.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One spare set for each unit.

#### 1.7 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of airhandling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

#### 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: York Solution Endura by Johnson Controls was selected as the basis of design manufacturer to maintain uniformity with the existing recently installed air handler serving other areas of the facility. The specifications herein, however, are not intended to be proprietary and shall be open to alternate manufacturers provided they meet the intent specified herein.

#### 2.2 GENERAL DESCRIPTION

- A. Air Handling Unit(s) (AHU) shall consists of a structural base, insulated casing, access doors, fans, motors, motor controls, coils, filters, dampers, controls, components, and accessories; as shown on drawings, schedules, and specifications.
- B. Provide AHU to meet the specified levels of performance for scheduled items including airflow, static pressure, cooling capacity, heating capacity, electrical characteristics, sound, casing leakage, panel deflection and casing thermal performance.
- C. AHU shall maintain structural integrity when wall panels are removed.
- D. Provide internal components and accessories as specified and scheduled. Components and accessories shall be installed by the AHU manufacturer in an ISO-9002 certified facility.
- E. Unit[s] shall be ship in one piece. Split unit(s) only where necessary for shipping and installation.
- F. Manufacturer shall provide detailed, step-by-step instructions for disassembly and reassembly.
- G. For AHU segments that must be broken down for rigging and installation: segment shall be disassembled and reassembled by manufacturer's factory-trained service personnel.

### 2.3 STANDARDS COMPLIANCE

- A. Manufacturer shall comply with ratings and certifications referenced in this specification.
- B. Manufacturers who do not comply with ANSI/AHRI-430 shall factory test EACH unit to verify brake horsepower rating, airflow performance and total static pressure performance.
- C. Manufacturers who do not conform to requirements of AHRI 260 for ducted discharge and return air sound shall submit EACH unit to an independent sound test laboratory for AHRI 260 testing. The test laboratory shall conform to AHRI 260, Section 4.4, Test Equipment and Facilities.

### 2.4 BASE RAIL

A. Unit(s) shall be provided with structural base rail under the full perimeter of the unit, formed from mill galvanized steel.

- B. Structural steel shall be installed providing clearance for proper external trapping of drain pans and steam condensate.
- C. Unit(s) shall be provided with base rail and lifting lug system that does not require additional support for rigging. Include base rail lifting lugs at unit corners.

## 2.5 CASING

- A. Casing construction shall not rely on the casing panels for structural integrity.
- B. Casing panels shall be 2" double-wall construction with thermal break. Thermal break shall be between interior and exterior liner of the panel assembly, and between the panel and casing framework.
- C. Provide casing with minimum thermal resistance (R-value) of 16 hr-ft<sup>2</sup>-°F/BTU. Exposed insulation is not acceptable.
- D. Casing panel insulation shall be injected polyurethane foam. Rigid foam board panels shall not be used.
- E. Casing framework downstream of cooling coil shall be filled with injected polyurethane foam insulation.
- F. All exterior and interior casing panels (roof, wall, floor, access door) shall be made of galvanized steel.
- G. Panel assembly shall meet UL standard 1995 for fire safety. Panel insulation shall comply with the requirements of NFPA 90A.
- H. Insulation system provided shall be resistant to mold growth in accordance with a standardized test method such as UL 181 or ASTM C 1338.
- I. Encapsulate insulation with sheet metal so that air does not contact insulation. Solid lined doublewalled panels insulated with injected foam shall be hermetically sealed at each corner and around their entire perimeter to eliminate airflow through the panel and to eliminate microbial growth potential within the casing wall.
- J. Unit shall conform to ASHRAE Standard 111 Class 6 for casing leakage no more than 1% of design airflow at 1.25 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections down to a minimum of 50 CFM measurable leakage or 5,000 design CFM.
- K. Provide wall panels and access doors that deflect no more than L/240 when subjected to 1.5 times design static pressure up to a maximum of +8 inches w.g. in positive pressure sections and -8 inches w.g. in negative pressure sections. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.
- L. Provide floors and roofs that deflect no more than L/240 when subjected to a 300 lb static load at mid-span. 'L' is the panel-span length and 'L/240' is the deflection at panel midpoint.

M. Provide outdoor AHUs with a roof system that deflects no more than L/240 when subjected to a static snow load of 30 lb./ft2. 'L' is defined as the panel-span length and 'L/240' is the deflection at the panel midpoint.

## 2.6 ROOF SYSTEM

- A. Membrane Roof system outer layer
  - 1. Shall have no points of penetration.
  - 2. Shall use no fasteners.
  - 3. Shall have no metal-to-metal seams joints.
  - 4. Shall not use or require caulking.
- B. Roof system shall be warranted by manufacturer against water penetration for a period of 10 years.
- C. Roof system shall be sloped with a minimum pitch of 1/8" per foot.
- D. Roof system shall overhang side and end panels by a minimum of 2."
- E. Doors shall have drip edge guard above door frame. Drip edge guard shall extend 2" beyond door surface.
- F. Field connection at roof of section splits shall not require use of fasteners, sealants or metal seam caps.

## 2.7 ACCESS DOORS

- A. Provide double wall access door(s) that meet requirements for the AHU casing.
- B. Thermal break door(s) shall incorporate a thermal break in both the door frame and the door panel. (Down Stream of First Cooling Coil)
- C. Provide industrial-style stainless steel hinges that permit 180 degrees of door swing.
- D. Provide latches with roller cam mechanisms that ensure a tight seal. Rotating knife-edge or "paw" latches are not acceptable.
- E. Provide each door with a single handle linked to multiple latching points or a separate handle for each latching point. Doors serving access segments shall have an interior latch handle.
- F. Provide access doors with a locking hasp to accommodate a lockout device.
- G. Provide double-pane viewing windows. Windows shall be a non-condensing type consisting of a desiccant dehumidification layer. Minimum dimension shall be 3" x 8".

## 2.8 GAS HEAT EXCHANGER

- A. Provide an indirect fired heating system having 81% minimum thermal efficiency and incorporating Listed Gas-fired Duct Furnaces manufactured by Heatco Inc. The Duct Furnace models HDA or HDB shall be listed by Intertek Testing Services (ITS / ETL) for operation on Natural or Propane gas to the current edition of ANSI Z83.8 Standard for Gas-Fired Duct Furnaces. Duct furnaces are for installation on the positive pressure side of the circulating air blower, only.
- B. Gas-fired duct furnaces provided shall have a tubular heat exchanger constructed of (Type 409 Stainless Steel .044 Min. Wall thickness produced to ASTM A268) or (Type 304L stainless tubes .047 Min. Wall thickness produced to ASTM A249) or (316SS). Heat exchanger design shall be suitable to withstand 3.0" w.c. total external static pressure without burner flame disturbance.
- C. Duct Furnaces shall be Listed for application downstream of refrigeration and cooling systems and shall provide means for removal of condensate that occurs in the tubes during cooling operation. Heat exchanger tubes shall have integral formed dimpled restrictors to provide for an unobstructed drainage path and tubes shall be formed to provide a positive pitch to promote condensate drainage.
- D. Turbulators or other tube inserts are not acceptable. Drainage shall be configured so that burners and burner surfaces are not exposed to condensate.
- E. Individual Duct Furnaces shall incorporate a Direct Spark Ignition control module that is design certified by a recognized national testing agency. The control shall provide
  - 1. 100% safety shut-off
  - 2. A 15 second minimum pre-purge period prior to trial for ignition
  - 3. High energy direct spark ignition of main burners
  - 4. Electronic flame supervision incorporating a 0.8 second flame failure response time
  - 5. Up to 2 additional ignition retrials preceded by an interpurge period
  - 6. A minimum 30 second post-purge
  - 7. Automatic reset after one hour to initiate additional ignition trials if lockout occurs during heat call
  - 8. An LED indicator light to provide a flash code to identify the operating condition of the control
- F. All electrical components shall be listed or recognized by a Nationally Recognized Test Laboratory (ETL, UL, CSA, etc.).
- G. Electronic Modulation- Operates from 20 to 100% of input based on an external analog input of 0 -10 VDC (supplied by others). Thermostat or heat enable contact (supplied by others) initiates and opens to end heating cycles. Furnace controls provide two-speed induced draft fan operation and electronic modulating controller to control modulating furnace section.
- H. Rack Assembly:
  - 1. All duct furnaces shall fit in a single 14 gauge galvanized metal frame
  - 2. 18 gauge galvanized sheet metal shall be used to optimize air flow across the furnaces
  - 3. The system design shall allow for removal of individual furnaces without disassembly

- 4. All wiring shall utilize quick connects for serviceability.
- 5. All wiring from the individual duct furnaces to the sequencer shall be completed. A connection panel for customer power, heat enable and analog input shall be provided
- 6. All individual furnace gas piping shall be pre-piped to a suitably sized main gas header
- 7. Each furnace shall have a flexible connector and manual isolation valve for easy service
- 8. All condensate lines shall be piped to a suitably sized CPVC header using high temperature silicon rubber tubing
- I. For Natural Gas, gas supply pressure to the gas valve inlet shall be:
  - 1. Racks with a max single furnace input over 400 MBH: 6.0" to 13.5" w.c.
- J. Units are orificed for operation up to 2000 ft. above sea level unless specified for high altitude operation.
- K. Duct furnaces shall be test fired prior to shipment to verify proper ignition, operation and shut down and satisfactory operation of all components.
- L. Each system shall be provided with printed installation and maintenance instructions, burner operating and maintenance instructions, piping and wiring diagrams and Installation Start-up data sheet
- M. Proof Vestibule / Flue Riser Option
  - 1. The system will further include a weather-proof vestibule section manufactured from 20 gauge pre-painted steel or other customer selected material including Galvaneal or G90 galvanized. The section shall enclose all exposed furnace components and include full length hinged doors with latches. Properly sized fresh air inlets with expanded metal guards shall be integral to the doors. An engineered double wall flue riser to vent flue gases shall be integral to the vestibule option. All electrical components shall be mounted within the vestibule section provided.

#### 2.9 COILS: HEATING AND COOLING

- A. Coils shall meet or exceed performance scheduled on drawings.
- B. Coils shall be provided with performance certified in accordance with AHRI Standard 410 for coil capacity and pressure drop, wherever applicable. Coils circuits shall be designed such that the fluid velocity is within the range of certified rating conditions at design flow.
- C. Cooling coils shall be provided with a maximum face velocity as scheduled. Face velocity calculations shall be based on the finned area of the coil.
- D. Cooling coil shall be provided with drain pan that is sufficient to contain coil condensate. Drain pan shall extend a minimum of [6"] downstream of the face of the coil.
- E. Coil segment casing shall accommodate full-face or reduced-face coils as scheduled.
- F. Access shall be provided of at least 18"between coils. Access panel or door shall be easily operable and are easily removable with no special tools, as shown on drawings.

- G. Access doors shall be located to provide clearance for pipe insulation, connectors, and accessories. Space shall allow a minimum of 90 degrees of door swing.
- H. Coils shall be built in their own full perimeter frame. Tube sheets on each end shall have fully drawn collars to support and protect tubes. Horizontal coil casing and support members shall allow moisture to drain. Casing and support members shall not block finned area.
- I. Individual coils shall be removable from the side of the AHU.
- J. Intermediate drain pan shall be provided on stacked cooling coils. Intermediate drain pan shall slope in a minimum of two planes toward a single drain connection.
- K. A single intermediate vertical coil support shall be provided on coils with a finned length greater than 62." Two vertical supports shall be provided on coils with a finned length greater than 100," and three vertical supports on coils with a finned length greater than 141."
- L. Gap between coil stub out connection and AHU casing, shall be insulated with a spool-shaped sleeve grommet. Adhesive rings applied to the casing walls shall not be acceptable.
- M. Water and glycol coils shall be operable at 325 psig working pressure and up to 250 deg F. Factory test water and glycol coils with 325 psig compressed air under water. Water coils shall conform to Subsection 12.3, "Water-Containing Parts," of UL-207, "Standard for Safety: Refrigerant Containing Components and Accessories, Nonelectrical."
- N. Water, glycol and DX coils shall be provided with a tube OD of 1/2" or 5/8". Mechanically expand tubes shall form fin bond and provide burnished, work-hardened interior surface.
- O. Continuous aluminum or copper fins shall be provided for coils with die-formed fins. Fins shall have fully drawn collars to accurately space fins and protect tubes. Fins shall be 0.006" or 0.008 or 0.01" thick.

### 2.10 PRIMARY DRAIN PANS

- A. Unit shall be provided with a drain pans under each cooling coil and humidifier.
- B. Provide drain pan under the complete width and length of cooling coil and humidifier sections. Drain pan shall be full width, and extend a minimum of 6" downstream of cooling coil.
- C. Drain pans for cooling coils and humidifiers shall meet the requirements of ASHRAE 62.
- D. Drain connection shall be made of same material as drain pan. Dissimilar metals shall not be used to mitigate risk of galvanic corrosion. Drain connection shall be welded to the drain pan.
- E. Drain pan shall be double wall with an insulation R-value of 6.25 hr-ft<sup>2</sup>- $^{\circ}F/(BTU-in)$ .
- F. Drain pan shall have minimum of 2" of injected polyurethane foam insulation under the entire bottom surface of the drain pan. Drain pan shall be foam injected as a complete assembly and shall include thermal breaks at connection points to unit casing.

- G. Drain pan shall allow visual inspection and physical cleaning on 100% of the pan surface without removal of the coil or humidifier.
- H. Provide a minimum of 1" clearance between the drain pan and any coil casing, coil support or any other obstruction.
- I. Provide drain pan that allows the design rate of condensate drainage regardless of fan status.
- J. Provide drain pan sloped in at least two planes by at least 1/8" per foot toward a single drain. Locate drain connection at the lowest point of the pan. Pan shall have no horizontal surfaces.

## 2.11 PIPE CHASE CABINET

- A. Provide pipe chases with double wall, insulated panels. Pipe chase shall have the same thermal performance as the unit casing.
- B. Provide a perimeter base rail and/or roof curb under the pipe chase that meets requirements for the AHU base rail and/or roof curb.
- C. Manufacturer may combine the pipe chase enclosures of adjacent segments.
- D. Provide a minimum 36" pipe chase depth, as shown on drawings. Pipe chase depth is the clear inside dimension from inner pipe chase surface to outer unit surface.
- E. In case, pipe chases shipped separate from AHU, manufacturer shall provide chases with lifting lugs for field installation per the AHU base rail requirements 'if required'.
- F. Manufacturer shall provide step-by-step instructions with illustrations for proper pipe chase installation.

### 2.12 FANS

- A. Unit shall be provided with fans as shown on equipment schedule and drawings.
- B. The fan section shall be provided with an access door on the drive side of the fan.
- C. Mount the fan and motor assembly on a common adjustable base. This common base shall attach to vibration isolators, which mount to structural support channels. These channels shall span the AHU floor and mount directly to the AHU frame. Manufacturers not complying with this requirement must submit detailed structural and weight data to a licensed structural engineer for review and stamped certification. The mechanical engineer shall review these engineers' final reports prior to submittal approval.
- D. Provide vibration isolation, as scheduled.
- E. DWDI fans shall be connected to the unit casing or bulkheads with canvas flexible connection.
- F. Bearings shall be offered either with sealed bearings (permanent lubrication) or with serviceable bearings to facilitate periodic relubrication. Bearings requiring relubrication shall offer grease

lines extended from the bearing to an accessible location on the fan-support bracket on the drive side of the fan.

- G. Piezometer Ring: Airflow station shall be factory installed at each fan inlet. The device shall have a measurement accuracy of  $\pm$  5%. Tubing shall be field-installed.
- H. Plenum (SWSI) Fan
  - 1. Plenum fan wheel shall be single-width, single-inlet.
  - 2. Plenum fan blades shall be aluminum backward-inclined airfoil.
  - 3. Plenum fan shall be direct-driven.

#### 2.13 BEARINGS AND DRIVES

- A. Fan bearings shall have average life (L50) of at least 200,000 hours. Bearing fatigue life ratings shall comply with ANSI/AFBMA 9.
- B. DWDI fans shall be belt-driven. SWSI fans shall be direct driven, as shown on product drawings.
- 2.14 ELECTRICAL MOTORS
  - A. Fan motors shall be built in accordance and comply with the latest standards of the NEMA and IEEE.
  - B. AHU and fan motors shall comply with ASHRAE 90.1.
  - C. Fan motors shall be provided with the following characteristics:
    - 1. Voltage, Frequency and Phase, as scheduled.
    - 2. Motor RPM, as scheduled
    - 3. Minimum service factor of 1.15
    - 4. Premium efficiency, or as required to meet ASHRAE 90.1
    - 5. NEMA design ball bearing type
    - 6. Rated for continuous duty at full load in a 104°F [40°C] ambient
    - 7. Open drip proof (ODP) or totally enclosed, fan cooled (TEFC) as scheduled.
    - 8. Suitable for use in variable frequency application, per NEMA MG-1 Part 30
    - 9. Premium Efficiency Inverter ready per NEMA STD MG1 PART 31.4.4.2

### 2.15 FAN-MOTOR DISCONNECTS

- A. Manufacturer shall provide UL or ETL listed fan-motor disconnects and associated components, as scheduled and shown on drawings. Disconnects shall comply with applicable provisions of the National Electric Code.
- B. Fused or non-fused fan-motor disconnects shall be provided in NEMA 3R as scheduled or as shown on drawings.

- C. Disconnects shall be mounted on the primary access side of the associated fan segment. Whereas, unit main disconnect shall be mounted on the primary access side of supply fan section.
- D. Disconnect shall be suitable for use as an OSHA lockout/tagout disconnect when applied in accordance with part IV, Department of Labor OSHA 29 CFR Part 1910, Control of Hazardous Energy Source (lockout/tagout): final rule.
- E. Disconnect handles shall be lockable in the "off" position with up to three padlocks. Switch mechanism shall be directly lockable in the "off" position via padlock when door is open.
- F. Disconnects shall be provided with integral ground lug.
  - 1. Provide two (2) #14 ground wires on 16A to 100A disconnects.
  - 2. Provide one (1) #6-250 ground wire on 200A to 400A disconnects.
- G. Auxiliary contacts shall be provided as scheduled.

## 2.16 FAN-MOTOR VARIABLE FREQUENCY DRIVES (VFDS)

- A. Manufacturer shall provide UL or ETL listed VFDs and associated components, as scheduled and shown on drawings. VFDs shall comply with applicable provisions of the National Electric Code.
- B. Outdoor VFDs shall be enclosed in a Heated NEMA 3R enclosure.
- C. VFDs on outdoor units shall be suitable for use in ambient temperatures from -20°F to 104°F:
- D. After unit installation, VFD shall be started and programmed by a factory trained and employed service technician. Refer to Section **Error! Reference source not found.**
- E. Unit(s) shall be provided with following VFD disconnect and bypass optional:
  - 1. Non-Fused, Fused main disconnect
  - 2. 2 contactor VFD bypass with VFD service input switch and Non-Fused, Fused main disconnect
- F. Unit(s) shall be provided with harmonic distortion feedback protection:
  - 1. Equivalent 5% impedance input line reactor
  - 2. Integral RFI/EMI filtering to meet EMC EN61800-3 for First Environment
- G. Unit(s) shall be provided with a user interface consisting of following features:
  - 1. 30 Character multi-lingual alphanumeric display
  - 2. Parameter set-up and operating data
  - 3. Display data shall include:

- a. output frequency (Hz)
- b. speed (RPM)
- c. motor current
- d. calculated % motor torque
- e. calculated motor power (kW)
- f. DC bus voltage
- g. output voltage
- h. heat sink temperature
- i. elapsed time meter (re-settable)
- j. kWh (re-settable)
- k. input / output terminal monitor
- 1. PID actual value (feedback) & error
- m. fault text
- n. warning text
- o. scalable process variable display
- H. VFD shall be provided with the following protection circuits:
  - 1. over current
  - 2. ground fault
  - 3. over voltage
  - 4. under voltage
  - 5. over temperature
  - 6. input power loss of phase
  - 7. loss of reference/feedback
  - 8. adjustable current limit regulator
- I. VFD shall be UL 508C approved for electronic motor overload (12t).
- J. VFD shall be provided with features for high input transient protection and surge suppression, such as
  - 1. 4 MOVs ahead of diode bridge
  - 2. 120 Joule rated 1600V diode module
  - 3. Compliant with UL 1449 / ANSI 61.4
- K. VFD shall be provided with the following communication features:
  - 1. Two programmable analog inputs
  - 2. Six programmable digital inputs
  - 3. Two programmable analog output
  - 4. Three programmable digital relay outputs
  - 5. Modbus RTU Communications protocol
  - 6. Adjustable filters on analog inputs and outputs
  - 7. Input speed signals, including 4-20 mA and 0-10 VDC
  - 8. Accel/Decel contacts: floating point control

- 9. Auto restart: customer selectable and adjustable
- 10. Integrated control interface for Siemens FLN, Johnson N2, Modbus RTU, BACnet MS/TP or LONWorks over RS-485.
- L. VFD shall consist of the following functions:
  - 1. Pre-magnetization on start
  - 2. DC braking/hold at stop
  - 3. Ramp or coast to stop
  - 4. Seven preset speeds
  - 5. Three critical frequency lockout bands
  - 6. Start function shall include ramp, flying start, automatic torque boost, and automatic torque boost with flying start

### 2.17 FACTORY INSTALLED ELECTRICAL ACCESSORIES

- A. In addition to motor power terminals, unit(s) shall be provided with an independent power terminal for convenience receptacles and lights.
- B. All switches shall be provided as shown on drawings.
- C. Unit[s] shall be provided with LED (light emitting diode) lights in filter, coil, amd fan segments as scheduled or shown on drawings.
- D. On supply fan segment 120V convenience receptacle shall be provided.

### 2.18 FILTERS

- A. Unit shall be provided with filter segments consisting of filters and frames as scheduled.
- B. Side or front loading filters for filter segments located upstream of coil segment(s) shall be provided with an access door on the drive side through which filters can be easily loaded.
- C. Segments located downstream of coil segment(s) shall be provided with face loading filters. Access plenum and access door of 18" [minimum] shall be provided on the drive side through which face loading filters can be easily loaded.
- D. Class 2 or Class 1 filter media shall be provided per U.L. 900 and as required by local codes.
- E. Filter types, efficiencies, and nominal depths shall be as follows:
  - 1. Flat filters –2" 30% MERV 8 as scheduled.
  - 2. Rigid filters 4" MERV 14 mini pleated
- F. Flush mounted, factory installed differential pressure gage on the drive side of unit shall be provided to measure pressure drop across filters. Manufacturer shall provide fully functional gauges, complete with tubing.

## 2.19 DAMPERS

- A. Dampers provided shall be tested in accordance with AMCA 500.
- B. Factory-installed dampers shall be provided, as shown on drawings.
- C. Dampers shall have airfoil blades, extruded vinyl edge seals, and flexible metal compressible jamb seals.
- D. Dampers shall have a maximum leakage rate of 4 CFM/square foot at 1" w.g., and shall comply with ASHRAE 90.1.
- E. Damper blades shall be parallel acting unless otherwise indicated.
- F. Damper blades shall be galvanized steel or aluminum, as scheduled.

## 2.20 AIRFLOW MONITORING STATIONS

- A. Airflow monitoring stations shall be provided on air inlets.
- B. Airflow monitoring stations shall bear the AMCA Certified Ratings Seal for Airflow Measurement Performance.
- C. Airflow monitoring station dampers shall comply with leakage rates per ASHRAE 90.1.
- D. Airflow monitoring stations shall be accurate within 5% of actual airflow between 300 FPM and 3000 FPM free area velocity.
- E. Field installed transducer provided by controls contractor.

### 2.21 APPURTENANCES

- A. Rain hoods shall be provided on outdoor unit air intakes, as shown on drawings. Moisture screens shall be provided on outdoor air inlet rain hoods.
- B. Steel, structural formed or welded base rails suitable for rigging and lifting shall be provided, as shown on product drawings.
- C. Safety grates over bottom openings shall be provided, as shown on drawings. Safety grates shall be capable of supporting a 300 lb. center load.
- D. Lifting lugs shall be provided where required.

### 2.22 EXTERIOR FINISHES

A. Manufacturer shall clean the exterior surfaces of units prior to application of exterior protective coating.

- B. Manufacturer shall paint exterior surfaces of outdoor units prior to shipment.
  - 1. Manufacturer shall apply a primer prior to application of finish coating.
  - 2. Exterior finish coating shall show a breakdown of less than 1/8" on either side of a scribed line when subjected to ASTM B117 2,000 hour, 5% salt spray conditions. This is equivalent to an ASTM D1654 rating of '6.' Also, per ASTM D610, degree of rusting to meet #8-G and per ASTM D714 degree of blister to meet #6 medium.

## 2.23 LIGHTS AND OUTLETS

- A. Lights
  - 1. Factory shall provide vapor resistant, marine type LED lighting fixture located in filter and coil/furnace access segments.
  - 2. Factory shall wire all light fixtures to a common 120v switch located on the supply fan segment.
- B. Outlets
  - 1. Factory shall provide a 15A GFI duplex outlet mounted in a weatherproof enclosure in segments and quantity as indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
- C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Protect unit interiors from moisture, construction debris and dust, and other foreign materials. Comply with Section 233113 "Ductwork" Paragraph: Field Quality Control.
- B. Unit Support: Provide unit level on structural steel supports. Coordinate roof penetrations and flashing with roof construction. Secure units to structural support with anchor bolts. Coordinate sizes and locations of steel supports with actual equipment provided.

- C. Provide filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.
- D. Provide separate devices furnished by manufacturer and not factory installed.
- E. Provide new filters at completion of equipment installation and before testing, adjusting, and balancing.

## 3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to units, allow space for service and maintenance.
- C. Connect piping to units mounted on vibration isolators with flexible connectors.
- D. Gas Piping: Comply with requirements in Section 221123 "Facility Fuel Gas Piping." Comply with requirements for gas-fired furnace installation in NFPA 54.
  - 1. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.
  - 2. Provide AGA-approved flexible connectors.
- E. Hydronic Piping Connections:
  - 1. Comply with requirements in Section 232113 "Hydronic HVAC Piping".
  - 2. Provide shutoff valve and union or flange on each supply connection and install balancing valve and union or flange on each return connection.
- F. Duct Connections:
  - 1. Comply with requirements in Section 233113 "Ductwork"
  - 2. Drawings indicate the general arrangement of ducts.
  - 3. Connect ducts to units with flexible duct connectors.

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Division 26.
- B. Ground equipment in accordance with Division 26.
- C. Provide electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Provide nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

E. Provide control and electrical power wiring to field-mounted control devices. Connect control wiring in accordance Division 26.

## 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup-checks in accordance with manufacturer's written instructions.
  - 2. Units with Gas Furnaces:
    - a. Inspect units for visible damage to furnace combustion chamber.
    - b. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:
      - 1) Measure gas pressure at manifold.
      - 2) Measure combustion-air temperature at inlet to combustion chamber.
      - 3) Measure flue-gas temperature at furnace discharge.
      - 4) Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
      - 5) Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
    - c. Clean furnace flue and inspect for construction debris.
    - d. Inspect operation of power vents.
    - e. Purge gas line.
    - f. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect high-limit heat exchanger and alarms.
  - 3. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
  - 4. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:
    - a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
    - b. Cooling coil entering-air, dry- and wet-bulb temperatures.
    - c. Condenser coil entering-air dry-bulb temperature.
    - d. Condenser coil leaving-air dry-bulb temperature.
  - 5. Simulate maximum cooling demand and inspect the following:
    - a. Compressor refrigerant suction and hot-gas pressures.
    - b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
  - 6. Inspect casing insulation for integrity, moisture content, and adhesion.
  - 7. Verify that clearances have been provided for servicing.
  - 8. Verify that controls are connected and operable.
  - 9. Verify that filters are installed.
  - 10. Clean coils and inspect for construction debris.

- 11. Inspect and adjust vibration isolators.
- 12. Verify bearing lubrication.
- 13. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
- 14. Start unit.
- 15. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
- 16. Operate unit for run-in period.
- 17. Calibrate controls.
- 18. Adjust and inspect high-temperature limits.
- 19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
- 20. Verify operational sequence of controls.
- 21. Measure and record the following airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Relief-air flow.
  - c. Outdoor-air flow.
- B. After startup, change filters, verify bearing lubrication, and adjust belt tension.
- C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.
- D. Prepare written report of the results of startup services.

### 3.6 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

# 3.7 FIELD QUALITY CONTROL

- A. Cleaning:
  - 1. Comply with Section 233113 "Ductwork" Paragraph: Field Quality Control.
  - 2. After completing system installation; testing, adjusting, and balancing unit and airdistribution systems; and completing startup service, clean units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.
- 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. Leak Test: After installation, fill coils with water, and test coils and connections for leaks.
  - 2. Charge refrigerant coils with refrigerant and test for leaks.
  - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Testing of Drain Pans. To minimize conditions of water stagnation that may result in microbial growth, inspect drain pans to verify proper drainage under operating conditions.

#### 3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 237314

## SECTION 261000 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Alternates: Refer to Division 01 to determine extent of, if any, work of this section that will be affected by any alternates if accepted.
- B. Furnish all materials, equipment, labor, and supplies and perform all operations necessary to complete the electrical work in accordance with the intent of the drawings and these specifications.
- C. Temporary Power and Lighting: Provide separate meter and service for construction area.
  - 1. Power Distribution: Provide weatherproof, grounded circuits with ground-fault interruption features, with proper power characteristics and either permanently wired or plug-in connections as appropriate for intended use. Provide overload-protected disconnect switch for each circuit at distribution panel. Space 4-gang convenience outlets (20 amp circuit) so that every portion of work can be reached with 100' extension cord.
  - 2. Temporary Lighting: Provide lighting of intensity and quality sufficient for proper and safe performance of the work and for access thereto and security thereof. (Consult OSHA requirements.)

#### 1.3 EFFICIENCY MAINE

- A. This project intends to pursue Efficient Maine prescriptive and/or custom incentives. The contractor shall be an Efficiency Maine Qualified Partner and shall participate in the activities associated with Efficiency Maine incentive pre-approval and approval process including but not limited to; preparation and submission of required incentive application(s) and the tracking and submission of measure specific invoices to Efficiency Maine within 60 days of the completion of the work.
- B. The contractor shall also:
  - 1. Become familiar with the Efficiency Maine Business Program including available incentives and the application and review process.
  - 2. Review plans and specifications for any and all incentive opportunities, prescriptive and custom.

- C. The project schedule shall reflect and accommodate the time required to achieve application preapproval from Efficiency Maine. No equipment shall be purchased until preapproval is received from Efficiency Maine.
- D. All invoices shall be forwarded to Efficiency Maine in accordance with Efficiency Maine requirements. This deliverable shall be shown on the project schedule as a milestone date and coordinated with all contractors to assure compliance with this requirement.

# 1.4 FIRE ALARM SYSTEM

A. Modify and add to the existing fire alarm system to provide a complete and code compliant system including but not limited to: new smoke detectors, heat detectors and notification appliances in all areas required. Fire alarm systems shall generally comply with requirements of NFPA 72 for local building systems except as modified and supplemented by this specification. All units of equipment shall be listed by Underwriters Laboratories and shall consist of a battery-backed fire alarm control station, with audio/visual and visual alarm indicating devices, heat detectors, smoke detectors, and pull stations. All equipment shall be located as shown on the plans and wired in accordance with the manufacturer's instructions to form a complete and workable emergency evacuation life safety system as hereinafter described.

### 1.5 QUALITY ASSURANCE

- A. All wiring shall be in accordance with the latest issue of the National Electrical Code.
- B. The Contractor shall show evidence, upon request, of having successfully completed at least five similar projects. Installation of each system shall be under the supervision of a factory-authorized organization.
- C. The Contractor shall show evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor must have a service contract program for the maintenance of the system after the guarantee period.
- D. All electrical equipment shall be listed by Underwriters Laboratories, Inc. Each system shall be products of a single manufacturer of established reputation and experience. The Contractor shall have supplied similar apparatus to comparable installations rendering satisfactory service for at least three years.
- E. For each system, the manufacturer shall furnish "gratis" to the Owner a one-year contract effective from the date of installation for maintenance and inspection services of the manufacturer's equipment with a minimum of two inspections during the contract year.
- F. Furnish the services of a competent instructor for not less than one four- hour period for instructing personnel in the operation and maintenance of the closed-circuit television system, on the dates requested by the Owner.

### 1.6 ARC-FLASH HAZARD STUDY AND IDENTIFICATION

- A. The work of this section includes updating the Owner's existing arc-flash hazard study to include equipment provided under this project. The existing study was performed using EasyPower computed software developed by ESA, Inc. The study shall be updated using computer software that is compatible with the existing study. The existing study document files shall be available for use in preparing the study specified herein.
- B. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- C. Comply with NFPA 70E and its Annex D for hazard analysis study.
- D. Provide arc-flash hazard warning labels as specified in Part 3 of this section

## 1.7 SUBMITTALS

- A. In accordance with Division 01, furnish the following:
  - 1. Manufacturer's descriptive literature: For each type of product indicated.
  - 2. Submit shop drawings which include engineering drawings of the system with specification sheets covering all component parts of the system and interconnection diagrams.
  - 3. Certification:
    - a. Prior to final inspection, deliver to the Owner's Representative certification that the material is in accordance with the drawings and specifications and has been properly installed.
    - b. Submit certification of system operating test.
  - 4. Manuals: Submit copies of complete set of operating instructions including circuit diagrams and other information of system components.

### 1.8 PROJECT CONDITIONS

- A. Regulatory Requirements:
  - 1. Conform to the requirements of all laws and regulations applicable to the work.
  - 2. Cooperate with all authorities having jurisdiction.
  - 3. Compliance with laws and regulations governing the work on this project does not relieve the Contractor from compliance with more restrictive requirements contained in these specifications.
  - 4. If the Contract Documents are found to be at variance with any law or regulation, the Contractor shall notify the Architect/Engineer promptly in writing. The Contractor shall assume full responsibility for any work contrary to law or regulation, and shall bear all costs for the corrections thereof.

- 5. Minimum Requirements: The National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), the National Fire Codes, and National Fire Protection Association (NFPA) are a minimum requirement for work under this section. Design drawings and other specification sections shall govern in those instances where requirements are greater than those required by code.
- B. Permits, Fees, and Inspections:
  - 1. Secure and pay for all permits, fees, licenses, inspections, etc., required for the work under Division 26.
  - 2. Schedule and pay for all legally required inspections and cooperate with inspecting officers.
  - 3. Provide Certificates of Inspection and Approval from all regulatory authorities having jurisdiction over the work in Division 26.
- C. Drawings:
  - 1. Do not scale the drawings. The general location of the apparatus and the details of the work are shown on the drawings, which form a part of this specification. Exact locations are to be determined at the building as the work progresses, and shall be subject to the Architect/Engineer's approval. Actual field conditions shall govern all dimensions.
  - 2. Anything shown on the drawings and not mentioned in the specifications or vice versa shall be provided as if it were both shown and specified.
  - 3. It is not intended that the drawings shall show every wire, device, fitting, conduit or appliance, but it shall be a requirement to furnish without additional expense, all material and labor necessary to complete the systems in accordance with applicable codes and the best practice of the trade.

### 1.9 WARRANTY

A. The Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects for one year from date of acceptance.

### 1.10 RELATED WORK

A. Division 23 - Mechanical

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Switches
  - 1. Toggle Switches: 20A, 277V, 1-pole, ivory specification grade, mount 4'-0" above finished floor at door entrance.

- 2. Push-Button Switches: Modular, momentary-contact, low-voltage type connected to lighting control panels. Use for all permanently installed luminaires unless otherwise noted. Mount 4'-0" above finished floor at door entrance.
- B. Switchbox type occupancy sensors: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. Configure for manual-on/automatic-off operation.
- C. Indoor Occupancy Sensors
  - 1. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
    - a. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
    - c. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
    - d. Mounting:
      - 1) Sensor: Suitable for mounting in any position on a standard outlet box.
      - 2) Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      - 3) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
    - e. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
    - f. Bypass Switch: Override the on function in case of sensor failure.
    - g. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
  - 2. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
    - a. Sensitivity Adjustment: Separate for each sensing technology.
    - b. 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., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
    - c. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
- D. Receptacles shall be specification grade, mounted 18" above finished floor unless otherwise noted.

- 1. Provide type TR tamper-resistant where required by code.
- 2. Provide type WR weather-resistant where required by code.
- E. Duplex Receptacles with Ground-Fault Interrupter shall be an integral unit suitable for mounting in a standard outlet box.
  - 1. Ground-Fault Interrupter shall consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120-volt, 20-ampere branch circuit. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second.
  - 2. Receptacle shall be rated 20 amperes, 125 volts for indoor use and shall be the standard duplex, three-wire, grounding type.
  - 3. Provide type WR weather-resistant where required by code.
- F. Weatherproof Receptacles shall consist of a duplex GFI receptacle, as specified, mounted in a weatherproof box with a gasketed, weatherproof, cast metal cover plate. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
- G. Plates shall be 302 stainless steel with tamper-proof screws.
- H. Boxes shall be steel minimum 2-1/2" deep.
- I. Light Fixtures: The light fixtures shall be as described on the drawings or approved equal.
- J. Disconnect Switches shall be heavy-duty type, horsepower rated.
- K. Motor Starters:
  - 1. Manual motor starters shall be toggle-switch type with melting alloy thermal overload relay. Thermal units shall be one-piece construction and interchangeable. Starter shall be inoperative with thermal unit removed. Contacts shall be double break, silver alloy. Starters in finished areas shall be flush mounted over the light switch at 60" above finished floor. Starters shall be mounted behind stainless steel device plate and shall have adjacent pilot lights. Square D Class 2510 Type FS-1P-FL1 or approved equal. Starters in unfinished areas shall be surface mounted 60" above finished floor. Square D Class 2510 Type FG-5P or approved equal.
  - 2. Magnetic motor starters shall be combination circuit breaker or fused disconnect switch type, mounted in a common enclosure. Starters shall be three-pole with three melting alloy overload relays. Overload heaters shall be coordinated with Division 23. Thermal units shall be of one-piece construction and interchangeable. Starter shall be inoperative with any thermal unit removed. The disconnect operating handle shall be position indicating.
    - a. Provide a control device and pilot light on the cover of each combination starter. Control devices for motors with remote manual or automatic control shall be "handoff-auto" switches. Control devices for locally controlled motors shall be "startstop" pushbuttons.

- b. 120-volt magnetic motor starters may consist of a circuit breaker or fused disconnect switch and a magnetic starter in separate enclosures mounted next to each other.
- c. Control circuits shall operate at a maximum of 120 volts. Provide control transformers as required.
- 3. Starters shall be mounted within NEMA-1 enclosures unless specified otherwise.
- 4. All starters shall be lockable in the "off" position.
- 5. Overload heaters shall be sized for the motor nameplate full-load amperes per the manufacturer's recommendations.
- L. Wiring Materials:
  - 1. Wiring shall be enclosed in electrical rigid galvanized steel, intermediate metal conduit, or electrical metallic tubing sized in accordance with code requirements for the conductors. Types MC or NM cable may be used where concealed in walls or ceilings and allowed by code.
    - a. Conduit fittings shall be steel compression type.
    - b. Terminations for all conduit shall have insulated bushings or insulated throat connectors in accordance with code requirements.
    - c. All conduits shall be substantially supported with approved clips or hangers spaced not to exceed ten feet on center. Minimum conduit size shall be 1/2".
  - 2. Flexible Metal Conduit shall be used for all connections to motors and vibrating equipment and shall comply with Fed. Spec. WW-C-566.
  - 3. Liquid-Tight Flexible Metal Conduit shall consist of flexible steel conduit with a liquid-tight PVC jacket over the conduit.
    - a. Fittings shall incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
    - b. Liquid-tight flexible metal conduit shall be used in damp or wet locations when flexible metal conduit would otherwise be used.
    - c. Liquid-tight flexible metal conduit shall not penetrate the roof or exterior walls, and shall not be installed in lengths exceeding 72" except where necessary for flexibility.
  - 4. All Wiring shall be type THW, XHHW, or THWN, UL labeled, copper conductors with 600-volt insulation, except as otherwise noted. Minimum size wire shall be No. 12 AWG.
  - 5. Nonmetallic-Sheathed Cable (Type NM) shall be two-or three-conductor with a ground conductor and an overall covering that is flame-retardant and moisture-resistant. Minimum wire size shall be No. 12 AWG.
  - 6. Type MC Cable shall have minimum No. 12 AWG type THWN or XHHW insulated copper conductors with an internal bare or insulated copper ground wire.
- M. Fire-Stop Material:
  - 1. Fire-stopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke, and gases under conditions of installation and use when exposed to the ASTM E 119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Fire-stopping material shall be noncombustible as defined by ASTM

E 136; and in addition for insulation materials, melt point shall be a minimum of 1700°F for one-hour protection and 1850°F for two-hour protection.

- 2. Seals for floor, exterior wall, and roof shall also be watertight.
- N. Circuit Breakers: Circuit breakers to be added to existing panelboards shall match existing circuit breakers; manufacturer, mounting type, AIC rating, voltage rating and UL listed for operation in respective panelboard.
- O. Panelboards:
  - 1. Provide standard manufacturer products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards shall be of the same manufacturer.
  - 2. All panels shall be dead front safety type.
  - 3. All panelboards shall be completely factory assembled with molded case circuit breakers.
  - 4. Panels shall have main breaker or main lugs, bus size, voltage, phase, and flush or surface mounting all as scheduled on the drawings. Panelboards to be used as service equipment shall be listed for such use.
  - 5. Panelboards shall have the following features:
    - a. Non-reduced size copper or aluminum bus bars and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps shall be arranged for sequence phasing of branch circuit devices.
    - b. Full size neutral bar mounted on insulated supports.
    - c. Ground bar with sufficient terminals for all grounding wires. The ground bar shall be insulated and isolated where called for on the drawings.
    - d. Buses braced for the available short-circuit current, but not less than scheduled and never less than 10,000 amperes symmetrical. All panelboards shall be fully rated. Series rated assemblies are not acceptable.
    - e. All breakers arranged so that it will be possible to substitute a two-pole breaker for two single pole breakers or a three-pole breaker for three single pole breakers when frame size is 100 amperes or less.
    - f. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors and without drilling or tapping.
    - g. Where designated, on panel schedule as "space", include all necessary bussing, device supports and connections. Provide blank cover for each space.
    - h. Provide galvanized steel cabinets to house panelboards. Cabinets for panelboards may be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
    - i. Back and sides shall be of one-piece formed steel. Cabinets for panelboards may be of formed sheet steel with end and side panels welded, riveted or bolted as required.
    - j. Provide minimum of four interior mounted studs and necessary hardware for in and out adjustment of panel interior.
    - k. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
    - 1. Surface trim shall have the same width and height as the box.
    - m. Provide doors with flush type latch and manufacturer's standard lock.
    - n. In making switching devices accessible, doors shall not uncover any live parts.
    - o. Provide concealed butt hinges welded to the doors and trims.
    - p. Provide keyed alike system for all panelboards.

- q. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.
- r. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips
- P. Transient Voltage Surge Suppressors (TVSS):
  - 1. Provide factory installed integral TVSS in panels where scheduled, listed in the specifications or indicated on the drawings. Field installed units shall not be acceptable.
  - 2. UL Listed, UL1449.
  - 3. Noise: less then 45 dBA at 5 feet.
  - 4. 3 phase, 4 wire plus ground.
  - 5. Dedication Modes:
    - a. Line to ground (L-G)
    - b. Line to Line (L-L)
    - c. Neutral to Ground (N-G)
    - d. Line to Neutral (L-N)
  - 6. Category C with 8 x 20 microsecond waveform.
  - 7. Joule rating shall meet or exceed ANSI/IEEE C62.41.
  - 8. 5 year warranty from shipping data against part failure.
  - 9. Quality Assurance
    - a. The specified system shall be thoroughly factory tested before shipment. Testing of each system shall include, but shall not be limited to, quality control checks, "Hi-Pot" tests at two times rated voltage plus 1000 volts per UL requirements, IEEE C62.41 Category B surge tests, UL ground leakage test, and operational and calibration tests.
    - b. The product shall be life cycle tested following suggested wait times as defined by ANSI/IEEE C62.45 and shall be capable of surviving 1000 sequential Category B surges of 10,000 Amps without failure.
    - c. The TVSS shall be provided with computer-generated graphs or oscillograms demonstrating the TVSS clamping voltage and operability. This test shall follow procedures outlined in ANSI/IEEE C62.45 for the installation category and applicable protection modes of the TVSS
- Q. Grounding Conductors:
  - 1. Grounding conductors shall be soft-drawn bare copper.
  - 2. Insulated grounding wires shall be UL and NEC approved types, copper, with THWN or XHHW insulation color identified green, except where otherwise shown on the drawings or specified.
  - 3. Wire shall not be less than shown on the drawings and not less than required by the NEC.

- R. Ground Clamps:
  - 1. Ground clamps shall be cast bronze or cast copper and shall be UL listed for grounding connections.
  - 2. Ground clamps shall be sized for the specific conductor and electrode to be clamped.
- S. Equipment Grounding Connections: Connections shall be of the compression type solderless connectors.
- T. Fire Alarm System Components:
  - 1. Fire alarm system components shall be compatible and listed for use with the existing fire alarm system, and shall match existing similar devices or be the system manufacturer's current recommended replacement for existing similar devices.
  - 2. Fire Alarm Control Panel: Provide all necessary common components, power supply, battery charger, batteries, programming, etc. as required to support the addition of components provided under this section for completion of a totally operational fire alarm panel and its respective remote annunciator when existing.
  - 3. Intelligent Duct Smoke Detector:
    - a. The duct smoke detector housing shall accommodate an intelligent ionization detector that provides continuous analog monitoring and alarm verification from the panel.
    - b. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
    - c. Provide sampling tubes as required by the ductwork.
    - d. Provide remote test/indicator stations where indicated. Provide engraved nameplate with HVAC unit designation for each station.
    - e. The detector shall use the photoelectric principal to sense products-of-combustion and report the measured level of such products to the control panel
  - 4. Provide addressable modules as required to monitor and control non-addressable devices such as solenoid valves, water flow switches, etc. indicated on the drawings and where required to provide a complete and operational system in accordance with the intent of the drawings and specifications. All shall be monitored separately.
  - 5. Sprinkler and Standpipe Valve Supervisory Switches:
    - a. Valve supervisory switches shall be furnished and installed under Div. 21 and wired and connected under this section.
  - 6. Conduit and Wire:
    - a. Wiring shall be in accordance with NEC Article 760, as shown on the drawings, and as recommended by the manufacturer of the fire alarm system. All wires shall be color-coded. Exposed wiring in unfinished areas shall be installed in metal conduit. Conduit fill shall not exceed 40 percent of interior cross-sectional area. Number and size of conductors shall be as recommended by the fire alarm system manufacturer.

Conduit shall be 1/2" minimum. Type FPL cable shall be permitted where concealed and acceptable to the Authority Having Jurisdiction.

- b. Wires in junction boxes and cabinets shall be permanently tagged and identified with tags.
- c. Junction boxes shall have a volume 40 percent greater than required by the NEC. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

### A. General:

- 1. All work shall be in accordance with the National Electrical Code's requirements as amended to date, with the local electric utility company's rules, the Fire Underwriter's requirements, and all local, state and federal laws and regulations.
- 2. In general, all wiring in finished areas shall be concealed in walls or above ceilings. Where wiring cannot be concealed due to existing construction, exposed wiring shall be installed in conduit or surface metal raceway as indicated on the drawings. Exposed wiring shall not be installed in finished areas without prior written authorization from the Engineer.
- 3. Conduits shall be of sizes required by the National Electrical Code. Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceiling, with right-angle turns consisting of bends, fittings, or outlet boxes. No wire shall be installed until work that might cause damage to wires or conduits has been completed. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.
- 4. Where conduits, wireways and other electrical raceways pass through fire partitions, fire walls, or floor, install a fire-stop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill clearances between raceways and openings. Floor, exterior wall, and roof seals shall also be made watertight.
- 5. Where raceways puncture roof, coordinate with Division 07.
- 6. Raceway penetrations through roof and exterior walls shall be made with rigid metal conduit, intermediate metal conduit, or EMT with compression fittings.
- 7. All splices shall be mechanically and electrically perfect, using crimp type wire connectors.
- 8. Provide all disconnect switches required by the N.E.C.
- 9. Locate motor starters as shown on drawings.
- 10. Mount disconnect switches and starters at a height of 60" above finished floor unless otherwise noted.
- 11. Provide all necessary hardware for mounting motor starters.
- 12. Revise existing panelboard directories. Furnish new cards as needed. Directories shall be typewritten or printed using a computer.
- 13. Mount the distribution equipment so that maximum height of circuit breakers or operating handle above finished floor shall not exceed 78".
- 14. Circuit numbers indicated on the drawings are the actual numbers assigned to the circuit in the panelboard and shall not be varied without the consent of the Architect/Engineer.
- 15. Provide all necessary hardware for mounting distribution equipment.

- 16. Branch circuit wiring may be nonmetallic-sheathed cable where concealed and allowed by Code, Type NM. NOTE: All romex shall be Properly Supported. (Provide continuous ground wire.)
- 17. Feeder circuit wiring shall be in conduit or EMT.
- 18. All wiring in outside walls shall be in conduit or EMT.
- 19. All wiring in masonry walls shall be in conduit or EMT.
- 20. In general, conductors shall be the same size from the last protective device to the load and shall have an ampacity the same as or greater than the ampacity of the protective device where the wire size is not shown on the drawings. Use the 60°C ampacity rating for wire sizes No. 12 through No. 1. For 120V circuits, home runs longer than 100 feet shall be minimum No. 10 AWG, longer than 200 feet shall be minimum No. 8 AWG.
- B. Fire Alarm System Installation:
  - 1. Installation shall be in accordance with the NEC Article 760, and the Americans with Disabilities Act and as shown on the drawings.
  - 2. Installation shall be as shown on the drawings and on the manufacturer's wiring diagrams, and shall be performed under the supervision of a factory-trained representative.
  - 3. All wiring shall be one wire per terminal to insure supervision. Crimp-on connectors shall not be used.
  - 4. All wiring shall be color-coded and tagged and shall be checked for continuity, short circuiting, and resistance to ground.
  - 5. All fire alarm wiring shall be installed in raceways.
  - 6. A factory-trained technician shall be present during testing and final inspection and shall instruct the Owner in system operation.
  - 7. Splices and taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
  - 8. Mounting Heights:
    - a. Manual Stations: 48" AFF
    - b. Visual Units: 80" above the highest floor level within the space or 6 in (152 mm) below the ceiling, whichever is lower.
  - 9. Tests:
    - a. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Owner's Representative.
    - b. When the systems have been completed and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Owner's Representative.
      - 1) Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
      - 2) Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
      - 3) Open fire alarm detector circuits to see if trouble signal actuates.
- 4) Check installation, supervision, operation and sensitivity of smoke detectors as recommended by the manufacturer to ascertain that they will avoid false alarm signals and will function as specified.
- 5) Perform any other tests recommended by the equipment manufacturer.
- 10. Final Inspection: At the final inspection a factory-trained representative of the manufacturer of the existing equipment shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Architect/Engineer
- C. Grounding:
  - 1. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
  - 2. Connections to junction boxes, equipment frames, etc., shall be bolted.
  - 3. Conduit Systems:
    - a. Ground all metallic conduit systems.
    - b. Conduit systems shall contain a grounding conductor sized per NEC Table 250-122 or as shown on the drawings. Increase conduit size where necessary to accommodate the grounding conductor.
  - 4. Feeders and Branch Circuits: Install green grounding conductors with all feeders and branch circuits.
  - 5. Lighting Fixtures: Conduits shall not be used for grounding fixtures. Green equipment grounding conductor must be bonded to all fixtures.
- D. Alterations:
  - 1. The Contractor shall study all drawings and specifications, visit the site, and acquaint himself with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to familiarize himself with the conditions and extent of the proposed work.
  - 2. The Contractor shall execute all alterations, additions, removals, relocations or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the drawing and specifications.
  - 3. Reconnect existing circuits to remain. Remove existing equipment to be discontinued.
  - 4. Any existing work disturbed or damaged by the alterations or new work shall be repaired or replaced to the Engineer's satisfaction.
  - 5. Equipment relocated or removed and reinstalled shall be cleaned and repaired to a firstclass condition before reinstallation.
- E. Continuity of Services: Arrange to execute work at such times and in such locations to provide uninterrupted service to the building or any of its sections. If necessary, temporary power shall be installed to provide for this condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal supply shall be performed during an overtime period to be scheduled with the Owner. Cost for overtime work shall be included in the bid.

- F. Identification:
  - 1. Provide tags on each end of all pulled wires giving location of other end.
  - 2. Provide phenolic nameplates for all panelboards, motor starters, disconnect switches (except switches located at motors), and duct smoke detector remote test/alarm-indicating stations.
  - 3. Label each receptacle faceplate using machine-printed thermal adhesive labels to indicate source panel and branch circuit. For receptacles connected to normal power, labels shall be white with black letters. For receptacles connected to circuits from operational standby (OS) panels, labels shall be red with white letters.
  - 4. Arc-Flash Warning Labels:
    - a. Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.
    - b. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
      - 1) Location designation.
      - 2) Nominal voltage.
      - 3) Flash protection boundary.
      - 4) Hazard risk category.
      - 5) Incident energy.
      - 6) Working distance.
      - 7) Engineering report number, revision number, and issue date.
      - 8) Labels shall be machine printed, with no field-applied markings.
    - c. Apply one arc-flash label for 480-V ac, and 208-V ac panelboards and disconnects and for each of the following locations:
      - 1) Motor-control center.
      - 2) Low-voltage switchboard.
      - 3) Switchgear.
      - 4) Medium-voltage switch.
      - 5) Control panel
- G. Record Drawings: The Contractor shall keep on the job a set of prints showing any changes to the installation. These shall be given to the Engineer at the completion of the work.
- H. Testing and Adjusting:
  - 1. The entire installation shall be free from short-circuits and improper grounds. Tests shall be made in the presence of the Engineer or his representatives.
  - 2. Each individual branch circuit shall be tested at the panel; and in testing for insulation resistance to ground, the equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code. Failures shall be corrected in a manner satisfactory to the Architect/Engineer.
  - 3. Each system shall be completely tested and shall be adjusted for proper operation as required by the Engineer.

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4. Final Inspection: At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Owner's Representative.

END OF SECTION 261000