

# VOLUME ONE PROJECT MANUAL BIDDING AND CONTRACT DOCUMENTS

JEFFERSON ELEMENTARY SCHOOL 800 SOUTH ALVES STREET HENDERSON, KY 42420 BG 19-068

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October 16, 2019

## JEFFERSON ELEMENTARY SCHOOL

## **DIVISION 0 - BIDDING AND CONTRACT DOCUMENTS**

# <u>SECTION</u>

00010	ADVERTISEMENT FOR BIDS	1 - 2
00100	INSTRUCTIONS TO BIDDERS - A1A A701	1 - 9
00102	SUPPLEMENTARY INSTRUCTIONS TO BIDDERS	1 - 6
00103	SUBSTITUTIONS	1 - 5
00200	FORM OF PROPOSAL	1 -12
00201	SUPPLEMENTAL FORM OF PROPOSAL	1 - 6
00202	CONFLICT OF INTEREST	1 - 1
00250	BID BOND - AIA A310	1 - 2
00280	KDOE PURCHASE ORDER SAMPLE	1 - 2
00300	GENERAL CONDITIONS - AIA A232 - 2009	1 -45
00302	SUPPLEMENTARY CONDITIONS	1 -11
00303	PREVAILING WAGES	1 -19
00304	SPECIAL CONDITIONS	1 - 8
00400	CONTRACT AGREEMENT - AIA A132-2009	1 -12
00450	PERFORMANCE/PAYMENT BOND - AIA A312-2010	1 - 8
00500	APPLICATION AND CERTIFICATE FOR PAYMENT AIAG732/G703	1 - 2
00550	CONTRACTORS AVVIDAVIT OF PAYMENT OF DEBTS AND CLAIMS-AIA G706	1 - 1
00600	CONSENT OF SURETY TO FINAL PAYMENT- AIA G707	1 – 1
00620	CONTRACTORS AFFIDAVIT OF RELEASE OF LIENS – G706A	1 - 1
00650	MECHANIC'S LIEN RELEASE	1 – 1

# **DIVISION 1 - GENERAL REQUIREMENTS**

01000	SITE CONDITIONS	1 – 2
01010	PROJECT CONSTRUCTION SCHEDULE	1 - 2
01030	ALTERNATES	1 - 1
01100	PROJECT COORDINATION	1 - 4
01200	PROJECT MEETINGS	1 - 3
01300	SUBMITTALS	1 - 3
01400	CODES, STANDARDS, AND INDUSTRY SPECIFICATIONS	1 – 2
01420	REFERENCES	1 - 17
01500	CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS	1 - 4
01600	PROJECT AS-BUILT DOCUMENTS	1 - 2
01650	PROGRESS PAYMENT AND CONTRACT CLOSE OUT PROCEDURES	1 - 2
01700	CUTTING AND PATCHING	1 - 2
01710	CLEANING	1 - 2
01900	LANGUAGE SPECIFIC TO INDIVIDUAL BIDS	1 –41

SECTION 00100

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Instructions to Bidders



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# Kentucky Department of Education Version of Market Algoright Al

## Instructions to Bidders

#### for the following PROJECT:

(Name and location or address) BRECKINRIDGE COUNTY AREA TECHNOLOGY CENTER ADDITION AND RENOVATION HARNED, KENTUCKY

THE OWNER:

(Name, legal status and address) BRECKINRIGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD HARDINSBURG, KY 40143

THE ARCHITECT: (Name, legal status and address) SHERMAN CARTER BARNHART 2405 HARRODSBURG ROAD LEXINGTON, KY 40504

#### TABLE OF ARTICLES

- 1 DEFINITIONS
- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
- 4 BIDDING PROCEDURES
- 5 CONSIDERATION OF BIDS
- 6 POST-BID INFORMATION
- 7 PERFORMANCE BOND AND PAYMENT BOND
- 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
- 9 PUBLIC WORKS ACT [Reference: KRS 337.505 to 337.550]
- 10 TAXES
- 11 POST BID REVIEW AND MATERIAL SUBMITTAL
- 12 EQUAL EMPLOYMENT AND NONDISCRIMINATION
- 13 CONFLICT OF INTEREST, GRATUITIES AND KICKBACKS, USE OF CONFIDENTIAL INFORMATION [Reference KRS 45A.455]
- 14 KENTUCKY FAIRNESS IN CONSTRUCTION ACT OF 2007 [Reference KRS 371.400 to 371.425]
- 15 KENTUCKY PREFERENCE LAW [Reference KRS 45A.490 to 45A.494]

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

#### **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 other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201<sup>™</sup>, or in other Contract Documents are applicable to the Bidding Documents.

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

§ 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 Form of Proposal for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids. The Base Bid shall include all labor, material, bonds, and the cost of all direct purchase orders for material to be purchased by the Owner

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of 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 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 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 personal observations with the requirements of the proposed Contract Documents.

1. The submission of a Bid will be construed as evidence that a site visit and examination of local conditions have been made. Later claims for labor, equipment, or materials required or difficulties encountered which could have been foreseen had such an examination been made will not be recognized.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

#### ARTICLE 3 BIDDING DOCUMENTS

#### § 3.1 Copies

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

#### § 3.1.2 (Not Used)

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§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

#### § 3.2 Interpretation or Correction of Bidding Documents

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect and Construction Manager (if utilized) errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect and Construction Manager (if utilized) at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will 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 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. 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.

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

§ 3.3.4 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 all who are known by the Architect and Construction Manager (if utilized) to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 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 Each Bidder shall ascertain prior to submitting a Bid 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 the Bidding Documents.

§ 4.1.2 All blanks on the Form of Proposal shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures 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."

**§ 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 make no additional stipulations on the Form of Proposal nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give 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.

#### § 4.2 Bid Security

§ 4.2.1 Each Bid greater than 25,000 shall be accompanied by bid security in the form of a Bond provided by a Surety Company authorized to do business in the Commonwealth of Kentucky, or in the form of a certified check, and in an amount equal to at least five percent (5%) of the Base Bid amount, pledging that the Bidder will enter into a contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payments 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.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document  $A310^{TM}$ , Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

#### § 4.3 Submission of Bids

§ 4.3.1 All copies of the Bid, the bid security, if any, 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.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids as indicated in the Advertisement or Invitation to Bid or any extensions thereof made by Addendum. Bids received after the closing time and date for receipt and opening of Bids will be rejected and returned to the Bidder unopened.

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

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

#### § 4.4 Modification or Withdrawal of Bid

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

#### **ARTICLE 5 CONSIDERATION OF BIDS**

#### § 5.1 Opening of Bids

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud.

#### § 5.2 Rejection of Bids

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

#### § 5.3 Acceptance of Bid (Award) [Reference: KRS 45A.365]

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. 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 own best interests.

§ 5.3.2 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 low 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

§ 6.1.1 Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305<sup>™</sup>, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.1.2 In determining the qualifications and responsibilities of the Bidder, the Owner shall take into consideration the Bidder's skill, experience, facility, previous work standing, financial standing, capacity and ability to handle work in addition to that in progress, and quality and efficiency of construction plant and equipment proposed to be used on the project.

#### § 6.2 (Not Used)

#### § 6.3 Submittals

 $\S$  6.3.1 Each Bidder shall submit as part of the Form of Proposal a list of subcontractors proposed for each major branch of work itemized and described in the specifications for the Project. The Bidder's listing of a subcontractor for a work category certifies that the subcontractor has in current employment, skilled staff and necessary equipment to complete that category. The Architect and Construction Manager (if utilized) will evaluate the ability of all listed subcontractors to complete the work and notify the Owner. Listing of the Bidder as the subcontractor may invalidate the Bid should the Architect's and Construction Manager's (if utilized) review indicate the bidder does not have skilled staff and equipment to complete the work category at the time the Bid was submitted.

.1 Changing subcontractors from those listed with the Form of Proposal is prohibited unless the bidder provides grounds for such a change that are consistent with provisions of the Instructions to Bidders. Said change shall be accompanied by a written explanation from the Bidder as well as a written release from the listed subcontractor. All letters shall be on original company stationary with original signatures from an officer in the company legally approved to act for the company. An unjustifiable change of subcontractors may invalidate the Bid. Any change to a proposed person or entity shall be addressed as noted in Section 6.3.3 of these Instructions to Bidders

§ 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 in writing 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, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover 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.

#### § 6.4 List of Materials, Suppliers, and Manufacturers

§ 6.4.1 Each Bidder shall submit a complete list of materials/equipment with supplier's and manufacturer's name in the form and manner indicated on the Form of Proposal and in compliance with materials and equipment specified.

§ 6.4.2 In addition to the list furnished with the Form of Proposal, the successful Bidder thereafter known as the Contractor, may be requested within thirty (30) calendar days after award of contract to furnish to the Architect and Construction Manager (if utilized) a more detailed and complete list of the materials and equipment, together with the manufacturer's or maker's name, brand and/or catalogue number, and product data or illustration thereof.

§ 6.4.3 Prior to the award of contract, the Architect and Construction Manager (if utilized) will make a preliminary check of the lists included with the Form of Proposal and advise the Bidder and the Owner of the acceptance thereof, and of such other actions as may be necessary in order to meet the requirements of the contract specifications. Should it develop that any of the materials or equipment named in the list do not meet the requirements of the project specifications, the Bidder shall be required to offer to the Owner other materials or equipment in compliance with the specifications at no change in contract price. Preliminary review and acceptance of the above list shall not relieve the Contractor of furnishing equipment and materials in accordance with the specifications.

§ 6.4.4 Written approval shall be obtained from the Architect regarding any material/equipment, supplier, and manufacturer substitution. Substitutions are permitted in the following instance:

- .1 Failure to comply with contract requirements;
- .2 Failure of the supplier or manufacturer to meet delivery schedules or other conditions of the contract;
- .3 Written release by the supplier or manufacturer.

§ 6.4.5 The Owner reserves the right to reject the bid of any Bidder who fails to furnish the information required under Sections 6.3 and 6.4.

#### § 6.5 Unit Prices

§ 6.5.1 Each Bidder shall submit as part of the Bid a list of unit prices as designated on the Form of Proposal.

§ 6.5.2 Unit prices are for changing or adjusting the scope or quantity of work from that indicated by the contract drawings and specifications.

§ 6.5.3 Unit prices shall include all labor, materials, equipment, appliances, supplies, overhead and profit.

§ 6.5.4 Only a single unit price per item shall be given and it shall apply for either more or less work than indicated or specified in the contract documents. In the event the contract is adjusted by unit prices, a change order shall be issued for the change and for the increased or decreased amount.

§ 6.5.5 Unit prices listed by the Bidder and accepted by the Owner shall apply to all phases of work whether the work is performed by the Bidder or by the Bidder's (Contractor's) subcontractors.

§ 6.5.6 For unit prices that apply to a lump sum Base Bid, the Owner reserves the right, prior to an award of contract, to negotiate, adjust and/or reject any price that is determined by the Architect, Construction Manager, or Owner to be excessive or unreasonable in amount.

§ 6.5.7 On line item total sum bids where Bidders are quoting firm unit prices for estimated quantities of units of work, the unit price is the Bid and is not subject to change, either by the Bidder or Owner. The Owner reserves the right to correct mathematical errors in extensions and additions by the Bidder. The Owner's corrected bid sum total shall take preference over the Bidder's computed bid sum total.

#### § 6.6 Bid Division, Material Suppliers, and Purchase Orders

§ 6.6.1 This Section applies to projects with or without Bid Division (Multiple Prime Contracts), and those Projects that provide for direct purchase by the Owner of materials and equipment from Material Suppliers.

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- .1 Within four (4) days from the Bid Date, the low Bidder shall furnish to the Owner the list of material suppliers of the items listed on the bid breakdown, with authorization given to the Contractor to quote the materials listed and that the Supplier will furnish the listed materials to the Owner under the Owner's standard Purchase Order for the amount stated on the Contractor's bid breakdown. Failure of any Contractor to provide this written list of material suppliers with authorization will cause forfeiture of the bid security.
- .2 The Contractor shall also guarantee to the Owner that materials listed in the breakdown to be purchased directly by the Owner shall comply with requirements of the Contract Documents and that the quantity of such material is sufficient to complete the Bid Division. The Performance and Payment Bonds required of the Contractor shall be in the combined amount of the materials designated in its bid to be acquired by Purchase Order by the Owner and all remaining items of cost in the respective Bid Division. Contractor shall provide an invoice from the supplier to the Owner with Contractor's Application for Payment.
- .3 Material Suppliers will be paid the full amount of their invoices. Retainage that would otherwise be withheld from invoices submitted by and paid to a material supplier shall be withheld from the approved payment request of the Contractor. Refer to General Conditions for further requirements regarding retainage.
  - .a Lockers, Library, Kitchen, Shop, Technology, Science or other major equipment bid divisions shall provide with their Bid a breakout price for the material portions of the Bid (excluding sales tax). Award of contract will be based on the lump sum price of the accepted Bid that includes labor and materials. The Owner will issue a Purchase Order for the material and a contract for the labor and incidental materials. Retainage will be held on both the Purchase Order and the Contract in accordance with the General Conditions.
  - .b The language of the Bid Divisions is designed to outline and define the work in general to be included in a particular Bid Division and to prevent overlapping and conflicting requirements within other Bid Divisions. No Bidder shall use the omission of any item from this language as a basis for a claim for additional cost when such item is specified or indicated to be part of a complete and workable system.
  - .c It is the responsibility of the Bidder to determine which Bid Division or combination of Bid Divisions the Bidder desires to Bid.

§ 6.6.3 For Projects without Bid Division but with direct purchase by the Owner of materials and equipment from Material Suppliers, Contractors shall comply with paragraph 6.6.2 above as applicable to the Project. The Owner will issue Purchase Orders direct to the suppliers for these materials. Award of contract will be based on the lump sum price of the accepted bid that includes labor and materials. Retainage will be held on both the Purchase Orders and the Contract(s) in accordance with the General Conditions.

#### ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

#### § 7.1 Bond Requirements

§ 7.1.1 Unless stipulated otherwise in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds shall be executed by a surety company authorized to do business in Kentucky.

§ 7.1.2 The cost of such bonds 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.

#### § 7.2 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 be commenced prior thereto 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<sup>TM</sup>-2010, Performance Bond and Payment Bond ---- KDE Version. Both bonds shall be written in the amount of the Contract Sum, being the total of the Base Bid, as described in Section 1.5 herein, and all Alternates accepted by the Owner.

§ 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 thereto a certified and current copy of the power of attorney.

#### ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101<sup>™</sup>-2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum — KDE Version, except for those Projects utilizing a Construction Manager the Agreement will be written on AIA Document A132<sup>™</sup>-2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Advisor Edition — KDE Version. Owner-Contractor Agreements shall be valid only after written notice by the Kentucky Department of Education that the proposed Agreements are approved.

#### ARTICLE 9 PUBLIC WORKS ACT [Reference: KRS 337.505 to 337.550]

#### § 9.1 Labor Regulations

§ 9.1.1 Work shall be performed in compliance with applicable provisions of the Kentucky Prevailing Wage Act on Public Works Projects, KRS 337.505 through KRS 337.550.

§ 9.1.2 Prevailing wage rates, included with the Bidding Documents, shall be paid on this Project if required under Section 10.1.1. The stipulated wage rates represent prevailing minimum wage rates of pay allowable and shall not be construed to mean that higher rates may not have to be paid in order to secure labor.

§ 9.1.3 Any Bidder and/or subcontract bidder in violation of any wage or work act provision (KRS 337.510 to KRS 337.550) and under citation by the Kentucky Department of Labor is prohibited by KRS 337.990 from bidding on or working on any and all public works contracts either in their name or in the name of any other company, firm, or other entity in which there is vested interest. No Bid shall be submitted by a prime Bidder or sub-bidder in violation of KRS Chapter 337. The responsibility of the qualifications of the sub-contract Bidder is solely that of the prime Bidder. The rejection of the subcontract Bidder and resubmitted of a qualified subcontract Bidder shall be addressed per the provisions of these Instructions to Bidders relating to subcontract Bidders (subcontractors) and materials.

#### § 9.2 Davis-Bacon Act Provisions

Projects funded with Federal Funds shall comply with the Davis-Bacon Act (Subchapter IV of Chapter 31 of the Title 40 of the United States Code). Where the amount received from federal revenue sharing is less than 25 percent of the estimated total construction cost of a public school project, state law and not the federal applies to the wage rate and the prevailing wage scale to be used for the project (OAG 74-329). Refer to Supplementary Conditions for direction regarding application of federal rates, if included in the bidding documents, to this project. In the event both state and federal wage rates apply, the higher of the two rates shall be used to determine labor costs.

#### ARTICLE 10 TAXES

#### § 10.1 Kentucky Sales and/or Use Tax [Reference KRS 139.495(1)]

Bidders are informed that construction contracts of the Commonwealth of Kentucky and political subdivisions are not exempt from the provisions of the Kentucky Sales and/or Use Tax, unless provisions are clearly noted in the bidding documents for the direct purchase of certain materials and equipment by the Owner. Materials and equipment which are to be submitted for direct purchase are as noted by the Architect or Construction Manager in the Form of Proposal and shall be limited to forty (40) items with a minimum price of \$5,000 each. All other materials and equipment shall be included in the Contract Price and are subject to Kentucky Sales and/or Use Taxes. Current Sales and/or Use Tax shall be provided for and included in the bid amount as no adjustment will be permitted nor made after the receipt of bids.

#### § 10.2 Federal Excise Tax

The Commonwealth of Kentucky and its political subdivisions are exempt from Federal Excise Tax.

#### ARTICLE 11 POST BID REVIEW AND MATERIAL SUBMITTAL

#### § 11.1 Representative at Bid Opening

§ 11.1.1 Each prime Bidder shall have an authorized representative at the bid opening for submittal of the list of materials and equipment, and the post bid review which follows immediately after the opening and reading of bids.

§ 11.1.2 Following the opening of bids, the three (3) apparent low Bidders shall remain for a post-bid review, and shall submit a completed list of materials, equipment and suppliers within one (1) hour from the close of the reading of the bids. The list of materials and equipment shall be the listing contained in the Form of Proposal.

§ 11.1.3 The post bid review, open to all bidders, will be conducted jointly with representatives of the Architect and Construction Manager (if utilized), Owner, and apparent low Bidder. Preliminary review will be directed toward Bidder's qualifications, list of subcontractors, list of materials and equipment, and unit prices.

#### ARTICLE 12 EQUAL EMPLOYMENT AND NONDISCRIMINATION

The Commonwealth of Kentucky and its political subdivisions are committed to equal job opportunities on public contracts and prohibited from discrimination based on race, creed, color, sex, age, religion, or national origin.

# ARTICLE 13 CONFLICT OF INTEREST, GRATUITIES AND KICKBACKS, USE OF CONFIDENTIAL INFORMATION [Reference KRS 45A.455]

Conflict of Interest, Gratuities, Kickbacks, and Use of Confidential Information as described in KRS 45A.455 are expressly prohibited. Penalties for any violation under this statute are located in KRS 45A.990.

#### ARTICLE 14 KENTUCKY FAIRNESS IN CONSTRUCTION ACT OF 2007 [Reference KRS 371.400 to 371.425]

Projects constructed for school districts in the Commonwealth of Kentucky are subject to provisions of the Kentucky Fairness in Construction Act of 2007 as it relates to the right to litigate, the right to delay damages against the Owner, the right to file a mechanic's lien, prompt payment by Owners, amount of retainage that can be withheld and other provisions of the Act.

#### ARTICLE 15 KENTUCKY PREFERENCE LAW [Reference KRS 45A.490 to 45A.494]

§ 15.1 Projects constructed for school districts in the Commonwealth of Kentucky are subject to provisions of the reciprocal preference for Kentucky Preference for Resident Bidders law, KRS 45A.490 to KRS 45A.494. Reciprocal preference shall be given by public agencies to resident bidders.

§ 15.2 The Kentucky Finance and Administration Cabinet shall maintain a list of states that give to or require a preference for their own resident bidders, including details of the preference given to such bidders, to be used by public agencies in determining resident bidder preferences. The cabinet shall also promulgate administrative regulations in accordance with KRS Chapter 13A establishing the procedure by which the preferences required by this Section shall be given.

§ 15.3 The reciprocal preference as described in KRS 45A.490 to KRS 45A.494 above shall be applied in accordance with Kentucky Administrative Regulation 200 KAR 5:400.

#### SECTION 00102 SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

#### 1. RELATION TO INSTRUCTIONS TO BIDDERS

The following Supplemental Instructions to Bidders modify or add to the Kentucky Department of Education Version of AIA Document A701-1997 INSTRUCTIONS TO BIDDERS. Where any Article of the Instructions is modified or any Paragraph, Subparagraph or Clause thereof is added, modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

#### 2. ARTICLE 2 BIDDERS REPRESENTATIONS

A. Add the following Subparagraphs 2.1.5, 2.1.6 and 2.1.7 to Paragraph 2.1

2.1.5 The Bidder shall be in compliance with equal employment and non-discrimination requirements of the Kentucky Equal Employment Act of 1978 and as defined in the Contract Documents.

2.1.6 The Bid shall be in compliance with requirements defined in the Bidding and Contract Documents for taxes and Kentucky Sales Tax.

#### 3. ARTICLE 3 BIDDING DOCUMENTS

- A. 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS
- (1) Modify Subparagraph 3.2.2 as follows:
- (2) Add the following Clause 3.2.2.1 to Subparagraph 3.2.2:

3.2.2.1 Bidder's written questions may be sent by e-mail to SHERMAN CARTER BARNHART, at (859) 224-8446. E-mail shall indicate the name of the project, "BRECKINRIDGE COUNTY AREA TECHNOLOGY CENTER".

(3) Add the following Subparagraph 3.2.4 and Clause 3.2.4.1 to Paragraph 3.2.

3.2.4 The Bidder shall study all Drawings and Specifications and all conditions relating to the erection of the Work, and if any materials or labor evidently necessary for the proper and complete execution of the Work, which are not specifically mentioned and included in the drawings and specifications, although reasonably inferred therefrom, unless eliminated by special mention, or if any error or inconsistency appears therein, or in the event of a doubt arising as to the true intent and meaning of the Drawings or Specifications, the Bidder shall report it to the Architect at least seven (7) days in advance of the date for receiving the bid. The Architect will issue an addendum containing the proper information to all Bidders.

3.2.4.1 In case the Bidder fails to make such report and the Architect is not otherwise advised of such doubtful matter, the Bidder shall be responsible for providing the necessary labor and material reasonably inferred or evidently necessary for the proper execution and completion of the Work; for any additional work involved in the correction of apparent errors or inconsistencies and in executing the true extent and meaning of the

#### SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

00102 page 1

Drawings and Specifications as interpreted by the Architect, and all such labor and materials shall be provided at the Bidder's expense and under no condition shall any such labor and material be allowed as a claim for additional cost or time to the Owner.

(4) Add the following Subparagraph 3.2.5 to Paragraph 3.2:

3.2.5 DISCREPANCIES: Anything called for in the Specifications and not shown on the Drawings and shown on the Drawings but not called for in the Specifications shall be provided as included in both. Where the details, general drawings and specifications do not agree, the Bidder shall notify the Architect at least seven (7) days before the date of the receipt of bids and the Architect will issue an Addendum to all Bidders as to which of the defined scopes of work shall be followed and to clarify the Contract Documents. Failure to make this determination shall make the Bidder subject to providing either scope of work as may be later determined by the Architect. In case of discrepancies between the various parts of the Drawings and Specifications, the Bidder shall provide the defined scope of work as may be determined by the Architect.

B. 3.4 ADDENDA

(1) Modify the first sentence of Subparagraph 3.4.1 as follows:

Between the words "Addenda will be" and "to all who" delete the word "transmitted" and substitute with the words "mailed or delivered".

(2) Add the following sentence to the end of Subparagraph 3.4.1:

"A facsimile shall not be an acceptable delivery method."

#### 4. ARTICLE 4 BIDDING PROCEDURE

A. 4.1 PREPARATION OF BIDS

(1) Add the following sentence to the end of Subparagraph 4.1.5:

"Voluntary alternate proposals and / or an alternate to the lump sum proposal shall not be considered."

- (2) Modify Subparagraph 4.1.6 as follows:
- a. Delete the first sentence, and;
- b. In the second sentence between the words "in any" and "manner" delete the word "other".
- B. 4.2 BID SECURITY
- (1) Modify the first sentence in Subparagraph 4.2.2 as follows:
- a. Delete the first word "If" of the first sentence.

- b. Between the words "Bid Bond" and "and the attorney-in-fact" delete the words "unless otherwise provided in the Bidding Documents".
- c. Add the following sentence to the end of Subparagraph 4.2.2:

"The Bid security shall be equal to 5 percent of the Bid amount."

- C. 4.3 SUBMISSION OF BIDS
- (1) Add the following to the end of the first sentence in Subparagraph 4.3.1

"and the Bid closing date in month / day / year / and time of day followed by am or pm as applicable."

(2) Modify Subparagraph 4.3.2 as follows:

In the second sentence between the words "receipt of Bids" and "be returned" delete the word "will" and substitute with the word "may".

(3) Add the following Clause 4.3.2.1 and Sub-Clauses 4.3.2.1.1 and 4.3.2.1.2 to Subparagraph 4.3.2:

4.3.2.1 Bids received after the time and date for receipt of Bids may be considered for evaluation and award only if:

4.3.2.1.1 No other Bids were received within the legal advertisement period, and;

4.3.2.1.2 The re-advertisement time delay would seriously affect the operations of the Project as determined by the Owner.

(4) Add the following Subparagraph 4.3.5 and 4.3.6 to Paragraph 4.3:

4.3.5 Unless otherwise defined in the Bidding Documents, the required materials and equipment listing shall be submitted by the apparent low Bidder or Bidders no later than one (1) hour after the close of the reading of the Bids The materials and equipment listing shall be that listing bound in the Form of Proposal.

D. 4.4 MODIFICATIONS OR WITHDRAWAL OF BID

(1) Add the following to the end of the second sentence in Subparagraph 4.4.2:

"by a properly identified representative of the Bidder, whose name appears on the Bid envelope, either in person or mailed or delivered."

(2) Add the following sentence between the second and third sentence in Subparagraph 4.4.2:

"Notices for modifications or withdrawal received through electronic means shall not be acceptable."

(3) Add the following Subparagraph 4.4.4 to Paragraph 4.4:

### SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

00102 page 3

4.4.4 Bid Security shall be in the amount of 5 percent of the Bid amount as modified or resubmitted.

(4) Add the following Subparagraph 4.4.5 to Paragraph 4.4:

4.4.5 Following the time and date designated for receipt of Bids, no Bidder may withdraw, modify or cancel it's submitted Bid for a period of thirty (30) calendar days without the Bid security being subject to forfeiture. The Bidder shall extend to the Owner the option of a thirty (30) calendar day extension to this initial calendar period upon written notice to the Bidder by the Owner, and received by the Bidder no later than the end of the initial calendar period.

#### 5. ARTICLE 5 CONSIDERATION OF BIDS

A. 5.3 ACCEPTANCE OF BID (AWARD)

(1) Add the following to the end of the first sentence in Subparagraph 5.3.1:

"and it is in the interest of the Owner to accept it."

(2) Add the following Subparagraph 5.3.3 to Paragraph 5.3:

5.3.3 In the event that a Bidder's proposal is accepted by the Owner and such Bidder shall fail to execute the Contract and to deliver satisfactory required bonds within the time period stipulated for the delivery of such bonds, the Owner may at its option, determine that the awardee has abandoned the Contract. Thereupon the proposal shall become null and void and the Bid security, which accompanied the Bid, shall be forfeited to, and become the property of, the Owner as liquidated damages from such failure. If the Bidder executes the Contract and delivers satisfactory required bonds, the Bid security will be returned to the Bidder by the Owner.

#### 6. ARTICLE 6 POST BID INFORMATION

- A. 6.1 CONTRACTORS QUALIFICATION STATEMENT
- (1) Add the following Subparagraph 6.1.1 to Paragraph 6.1:
- 6.1.1 The listing of more than one subcontractor in a work category shall invalidate a Bid.
- (2) Add the following Subparagraph 6.1.2 to Paragraph 6.1:

6.1.2.1 The Owner will assume responsibility for all Kentucky sales tax relative to purchase order items as defined by the requirements in the Bidding and Contract Documents.

#### B. 6.3 SUBMITTALS

(1) Modify Subparagraph 6.3.2 as follows:

In the first sentence substitute "Construction Manager" for "Architect",

### SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

- (2) Modify Subparagraph 6.3.3 as follows:
- a. In the first sentence following the word "Owner" add "and Construction Manager";
- b. In the first sentence between the words "satisfaction of the" and "and Owner" substitute "Construction Manager" for "Architect" and between the words "or Architect," and "after due" add "or Construction Manager".
- c. In the second sentence between the words "or entity with" and "adjustment in the" delete the word "an" and substitute with the word "no";
- d. In the second sentence following the word "Alternate Bid" delete the remainder of the sentence "to cover the difference in cost occasioned by such substitution";
- e. Delete the third sentence;
- f. Delete the fourth sentence and substitute with the following:

"In the event of withdrawal, bid security will not be forfeited."

b. Add the following sentence to the end of Subparagraph 6.3.3:

"The Bidder may be required by the Owner to provide additional information regarding the listed persons and entities proposed."

(3) Modify Subparagraph 6.3.4 as follows:

In the first sentence after the words "Owner and Architect", in both locations where they appear, add "and Construction Manager".

(4) Add the following Subparagraph 6.3.5 to Paragraph 6.3.

6.3.5 Materials and equipment proposed for the Work by the Bidder shall be in compliance with requirements defined in the Contract Documents. Prior to the execution of the Contract, the Owner will advise the Bidder of the tentative acceptability of such materials and equipment, subject to the satisfactory completion and approval of shop drawings, or direct such other action as may be necessary to meet the requirements of the Contract Documents. If any of the listed materials or equipment is determined not to meet the requirements of the Contract Documents, the Bidder shall provide other materials or equipment, which meet those requirements with no adjustment in the Base Bid or Alternate Bid. Tentative acceptability of the list of proposed materials and equipment by the Owner shall not relieve the Bidder, of the obligations to provide materials and equipment in accordance with the Contract Documents.

- 7. ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND
  - A. 7.2 TIME OF DELIVERY AND FORM OF BONDS
  - (1) Modify Subparagraph 7.2.1 as follows:

### SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

In the first sentence between the words "not later than" and "the date of" delete the words "three days following".

(2) Add the following Clauses 7.2.1.1 and 7.2.1.2 to Subparagraph 7.2.1.

7.2.1.1 The Bidder, prior to commencement of the Work in response to a letter of intent, and prior to the execution of the Contract, may request approval from the Owner to a delivery extension of the required bonds to be no later than ten (10) calendar days following the date of the execution of the Contract. Such request shall include evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with bond requirements.

7.2.1.2 If the Bidder fails to deliver required bonds in accordance with Subparagraph 7.2, subject to approval of a delivery extension as herein defined, the Owner may, at it's option, determine that the Bidder has abandoned it's Bid and shall have forfeited the Bid security.

#### END OF SECTION

SECTION 00103 SUBSTITUTIONS PAGE 1

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provision of Contract, including General and Supplementary Conditions and other Division - 1 Specification Section, apply to this Section.
- B. Refer to Instructions to Bidders, Article No. 3. 3.3 Substitutions Materials and Equipment and as modified by Supplementary Instructions to Bidders.
- 1.2 SUMMARY
  - A. This section specifies administrative and procedural requirements for handling requests for substitutions and includes the following:
    - 1. Request for substitutions made prior to receipt of Bids.
    - 2. Request for substitutions made after to receipt of Bids.
    - 2. Request for substitutions made after award of the Contract.
  - B. Related Sections:
    - 1. The Contractor's construction schedule is included under section. "Project Schedule".
    - 2. The Schedule of Submittals is included under section, "Submittals".

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where 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. Such standards are made a part of the contract documents by reference. Individual sections indicate which codes and standards the Contractor must keep available at the project site for reference.
- 1.4 REQUEST FOR PRODUCT SUBSTITUTIONS General:
  - A. Submit three (3) copies of each request for substitution and one (1) fully completed and signed copy of the "Request for Approval of Acceptable Product" available from the Construction Manager.
  - B. In each request, identify the product, or the fabrication on installation method to be replaced by the substitution. Include related Specification Section and drawing numbers and complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate with each request.

- C. Provide complete Product Data, including drawings and descriptions of products, fabrication and installation procedures.
- D. Provide samples, where applicable or requested.
- E. Provide detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
- F. Certificate of Compliance: Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation that the substitution proposed is in every significant respect equal to or better to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
- G. Substitution requests shall satisfy the following conditions. If the following conditions are not satisfied, the Architect will return requests without action except to record non-compliance with these requirements.
  - Requested substitution offers the Owner a substantial advantage in cost, time, energy conservation or other consideration, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, compensation to the Construction Manager for coordination and evaluation services, and any similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents as determined by the Architect.
  - 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 Project Construction Schedule.
  - 6. Requested substitution is contingent on receiving necessary approvals of Authorities Having Jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution provides specified Warranty.

SECTION 00103 SUBSTITUTIONS PAGE 3

- 1.5 REQUEST FOR PRODUCT SUBSTITUTIONS made prior to receipt of Bids:
  - A. <u>Substitutions of other equipment and materials named in the specifications will be allowed only when approved by the Architect and defined in a Bid Addendum, provided that written request for approval of proposed product substitutions is received by the Construction Manager at least ten (10) days prior to the Bid date. A copy of the request for substitution of mechanical and electrical equipment and materials shall be sent directly to the Mechanical and Electrical Engineer, as applicable.</u>
  - B. Architect's action: After review by the Architect, such request, if approved, will be included in an addendum.
- 1.6 REQUEST FOR PRODUCT SUBSTITUTIONS made after receipt of Bids
  - A. A request for substitution of major equipment and materials named in the specifications and previously submitted by the Contractor and approved by the Architect, will be considered only for the following reasons:
    - 1. Unavailability of material or equipment.
    - 2. Inability of supplier to meet Contract schedule.
    - 3. Technical noncompliance to specifications.
  - B. Provide a statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time. If specified product cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
  - C. Provide complete cost information, including a proposal of the net change, if any in the Contract sum.
  - D. Contractor's waiver of rights to additional payment or time that may be subsequently become necessary, because of failure of proposed substitution to produce indicated results.
  - E. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for application indicated.
  - F. Substitution requests shall satisfy previous conditions defined herein and the following conditions. If the following conditions are not satisfied, the Architect will return requests without action except to record non-compliance with these requirements.

- 1. 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.
- 1.7 REQUEST FOR PRODUCT SUBSTITUTIONS made after award of Contract
  - A. A request for substitution in products, materials, and equipment required by Contract Documents proposed by the Contractor after Award of the Contract will be considered only for the following reasons:
    - 1. Unavailability of material or equipment.
    - 2. Inability of supplier to meet Contract schedule.
    - 3. Technical noncompliance to specifications.
  - B. Certificate of Compliance: Provide certification by the Contractor to the effect that, in the Contractor's opinion, after thorough evaluation that the substitution proposed is in every significant respect equal to or better to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
  - C. Substitution requests shall satisfy previous conditions for substitutions proposed before or after bidding as herein defined. If the conditions are not satisfied, the Architect will return requests without action except to record non-compliance with these requirements.
  - D. The following are not considered substitutions:
    - Substitutions requested by bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this section for substitutions;
    - 2. Revisions to Contract Documents requested by the Owner or Architect;
    - 3. Specified options of products and construction methods included in Contract Documents;
    - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

BG No. <u>19-068</u>				
Date:	To: (Owner) HEND	ERSON COUNTY BOE		
Project Name: JE	FFERSON ELEMENTARY SC	CHOOL	Bid Package No.	
City, County:				
Name of Contract	or:			
Mailing Address:				
Business Address	:	Telephone:		
Having carefully e Specifications, an materials, equipm contract documen	xamined the Instructions to Bi d Drawings, for the above r nent, tools, supplies, and ter ts and any addenda listed below (Insert the adder	dders, Contract Agreement, C eferenced project, the under nporary devices required to ow for the price stated herein.	General Conditions, Supplementa rsigned bidder proposes to furn complete the work in accorda	al Conditions, ish all labor, nce with the
BASE BID: For the following lump	e construction required to con sum price of:	mplete the work, in accordan	ce with the contract documents,	I/We submit
		Use Figures	-	
	Dollars &	Ce	ents	
Use	Words		Use Words	
ALTERNATE BID	<u>S:</u> (If applicable and denoted i	n the Bidding Documents)		
For omission fror number, the follow	n or addition to those items <i>i</i> ing lump sum price will be ad	s, services, or construction s ded or deducted from the bas	pecified in Bidding Documents e bid.	by alternate
Alternate Bid No.	Alternate Description	+ (Add to the Base Bid)	- (Deduct from the Base Bid)	No Cost Change from the Base Bid)
Alt. Bid No. 1				
Alt. Bid No. 2				
Alt. Bid No. 3				
Alt. Bid No. 4				
Alt. Bid No. 5				
Alt. Bid No. 6				
Alt. Bid No. 7				
Alt. Bid No. 8				
Alt. Bid No. 9				
Alt. Bid No. 10				

A maximum of 10 Alternate Bids will be acceptable with each Base Bid. Do not add supplemental sheets for Alternate Bids to this document.

#### LIST OF PROPOSED SUBCONTRACTORS:

List on the lines below each major branch of work and the subcontractor involved with that portion of work. If the branch of work is to be done by the Contractor, so indicate.

The listing of more than one subcontractor in a work category shall invalidate the bid.

The listing of the bidder as the subcontractor for a work category certifies that the bidder has in current employment, skilled staff and necessary equipment to complete that category. The architect/engineer will evaluate the ability of all listed subcontractors to complete the work and notify the owner. Listing of the bidder as the subcontractor may invalidate the bid should the architect's review indicate bidder does not have skilled staff and equipment to complete the work category at the time the bid was submitted.

A maximum of 40 subcontractors will be acceptable with each bid. Do not add supplemental sheets for subcontractors to this document.

The bidder shall submit the list of subcontractors with the bid.

	BRANCH OF WORK (to be filled out by the Architect)	SUBCONTRACTOR (to be filled out by the contractor)
1.	Site Utilities	
2.	Concrete	
3.	Masonry	
4.	Casework	
5.	Steel Erection	
6.	Wall Panels	
7.	Plumbing	
8.	HVAC	
9.	Insulation	
10.	HVAC Controls	
11.	Geothermal	
12	Lighting Controls	
13	Voice and Data	
14	Secutiry System	
15	Fire Alarm	
16		
17		
17.		

# KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

	BRANCH OF WORK (to be filled out by the Architect)	SUBCONTRACTOR (to be filled out by the Contractor)
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		
27.		
28.		
29.		
30.		
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37		
38		
30.		
40		

#### LIST OF PROPOSED SUPPLIERS AND MANUFACTURERS:

List on the lines below each major material category for this project and the suppliers and manufacturers involved with that portion of work. Listing the supplier below means the Contractor is acknowledging authorization from the Supplier to include the Supplier in this bid.

The listing of more than one supplier or manufacturer in a material category shall invalidate the bid.

# A maximum of 40 suppliers and manufacturers will be acceptable with each bid. Do not add supplemental sheets for suppliers to this document.

The bidder shall submit the list of suppliers and manufacturers within one (1) hour of the bid.

	MATERIAL DESCRIPTION BY   SPECIFICATION DIVISION AND   CATEGORY   (to be filled out by the Architect or Contractor)	SUPPLIER (to be filled out by the Contractor)	MANUFACTURER (to be filled out by the Contractor)
1.	Stone		
2.	Storm Structures and Pipe		
3.	Concrete		
4.	ICF Forms		
5.	СМИ		
6.	Brick		
7.	Metal Wall Panels		
8.	Insulated Wall Panels		
9.	Gyp Assemblies		
10.	Acoustical Ceilings		
11.	Paint		
12.	Casework		
13.	Structural Steel		
14.	Metal Joist and Deck		
15.	Roof System		
16.	Carpet		
17.			
18.			

# KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

	MATERIAL DESCRIPTION BYSPECIFICATION DIVISION ANDCATEGORY(to be filled out by the Architect or Contractor)	SUPPLIER (to be filled out by the Contractor)	MANUFACTURER (to be filled out by the Contractor)
19.			
20.			
21.			
22.			
23.			
24.			
25.			
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#### UNIT PRICES:

Indicate on the lines below those unit prices to determine any adjustment to the contract price due to changes in work or extra work performed under this contract. The unit prices shall include the furnishing of all labor and materials, cost of all items, and overhead and profit for the Contractor, as well as any subcontractor involved. These unit prices shall be listed in units of work.

# A maximum of 40 unit prices will be acceptable with each bid. Do not add supplemental sheets for unit pricing to this document.

#### The bidder shall submit the list of unit prices within one (1) hour of the bid.

	WORK (to be filled out by the Architect)	PRICE / UNIT (to be filled out by the Contractor)	UNIT (to be filled out by the Contractor)
1.			
2.			
3.			
4.			
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14.			
15.			
16.			
17.			
18.			
19.			
	(to be filled out by the Architect)	PRICE / UNIT (to be filled out by the Contractor)	UNIT (to be filled out by the Contractor)

# KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

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#### DIRECT MATERIAL PURCHASES:

Indicate on the lines below those materials to be purchased directly by the Owner with a Purchase Order to be issued by the Owner to the individual suppliers. The value of the direct Purchase Order cannot be less than \$5,000. Following the approval of bids, the Contractor shall formalize this list by completing and submitting the electronic Purchase Order Summary Form provided by KDE. Listing the supplier below means the Contractor is acknowledging authorization from the Supplier to include the Supplier in this bid.

# A maximum of 50 POs will be acceptable with each bid. Do not add supplemental sheets for additional POs to this document.

The bidder shall submit the list of Purchase Orders within four (4) days of the bid.

	SUPPLIER	PURCHASE ORDER DESCRIPTION	PURCHASE ORDER AMT.
	(to be filled out by the Contractor)	(to be filled out by the Contractor)	(to be filled out by the Contractor)
1.			
2.			
3.			
4.			
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11.			
12.			
13.			
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# KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

	SUPPLIER (to be filled out by the Contractor)	PURCHASE ORDER DESCRIPTION (to be filled out by the Contractor)	
20.			
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# KENTUCKY DEPARTMENT OF EDUCATION 702 KAR 4:160

	SUPPLIER (to be filled out by the Contractor)	PURCHASE ORDER DESCRIPTION (to be filled out by the Contractor)	PURCHASE ORDER AMT. (to be filled out by the Contractor)
45.			
46.			
47.			
48.			
49.			
50.			

#### TIME LIMIT FOR EXECUTION OF CONTRACT DOCUMENTS:

In the event that a bidder's proposal is accepted by the Owner and such bidder should fail to execute the contract within ten (10) consecutive days from the date of notification of the awarding of the contract, the Owner, at his option, may determine that the awardee has abandoned the contract. The bidder's proposal shall then become null and void, and the bid bond or certified check which accompanied it shall be forfeited to and become the property of the Owner as liquidated damages for failure to execute the contract.

The bidder hereby agrees that failure to submit herein above all required information and/or prices can cause disqualification of this proposal.

Submitted by:

NAME OF CONTRACTOR / BIDDER: \_\_\_\_\_

AUTHORIZED REPRESENTATIVE'S NAME:

Signature

AUTHORIZED REPRESENTATIVE'S NAME (printed): \_\_\_\_\_

AUTHORIZED REPRESENTATIVE'S TITLE: \_\_\_\_\_

NOTICE: Bid security must accompany this proposal if the Base Bid price is greater than of \$25,000.

This form shall not be modified.

### **SECTION 00202**

### SUPPLEMENTAL FORM OF PROPOSAL - PAGE 1 OF 1

### (MUST BE SUBMITTED WITH SECTION 00200 - FORM OF PROPOSAL)

### CONFLICT OF INTEREST

It shall be a breach of ethical standards for any employee with procurement authority to participate directly in any proceeding or application; request for ruling or other determination; claim or controversy; or other particular matter pertaining to any contact or subcontract, and any solicitation or proposal therefore, in which to his knowledge:

- a. he, or any member of his immediate family, has a financial interest herein; or
- b. a business or organization which he or any member of his immediate family has a financial interest as an officer, director, trustee, partner, or employee is a party; or
- c. any other person, business, shareholder or other stockholder, or organization with whom he or any member of his immediate family is negotiating or had an arrangement concerning prospective employment is a party. Direct or indirect participation shall include, but not be limited to, involvement through decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigating, auditing or in any other advisory capacity.

It is a violation of Kentucky law for any board member or employee, or a member of their immediate family, to have a pecuniary interest either directly or indirectly in an amount exceeding \$25.00 per year in any purchase of goods or services by the BRECKINRIDGE COUNTY BOARD OF EDUCATION. Violation of this provision subjects the member or employee to forfeiture of their position and/or employment with the BRECKINRIDGE COUNTY BOARD OF EDUCATION.

I hereby certify that no member of my immediate family is an employee or member of BRECKINRIDGE COUNTY BOARD OF EDUCATION.

Signature

Date

References: KRS I56.480, OAG 80-32, Model Procurement Code 45A.455

Note: This certificate must be signed and attached to the Form of Proposal in order for Bid to be qualified.

#### **SECTION 00250**



### **Bid Bond**

**CONTRACTOR:** (Name, legal status and address) SURETY: (Name, legal status and principal place of business)

OWNER:

(Name, legal status and address) **BRECKINRIDGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD** HARDINSBURG, KY 41043

#### **BOND AMOUNT: \$**

#### PROJECT:

(Name. location or address, and Project number, if any) BRECKINRIDGE COUNTY AREA TECHNOLOGY CENTER ADDITION AND RENOVATION HARNED, KENTUCKY

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so

#### 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.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

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(1383240049)

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furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal)	(Seal)
(Witness)	(Title)	
	(Surety)	(Seal)
(Witness)	(Title)	

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# KENTUCKY DEPARTMENT OF EDUCATION

# **PURCHASE ORDER**

702 KAR 4:160

Board of Education:	BG#		
	District PO Number:		
	(THIS PURCHASE ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES AND SHIPPING PAPERS) Project Name:		
7			
Kentucky Sales Tax Exemption Number:	Bid Package No.:		
Date of Order:	Specification Section:		
Vendor Name:	Material Description / Category:		
Vendor Address:	Facility Name:		
	Requested By:		
Vendor Phone:	AUTHORIZATION		
Vendor Email:	ACKNOWLEDGED AND MADE PART OF THIS ORDER.		
Bill To:	Owner Authorized Name:		
Bill to Address:	Owner Authorized Signature:		
	Owner Authorization Date:		
Ship To:			
Ship to Address:	Vendor Authorized Name:		
	Vendor Authorized Signature:		
Attention of:	Vendor Authorization Date:		

The following project contacts must be notified 48 hours in advance of delivery to jobsite.

Contact Name	Phone Number	Contact Name	Phone Number

Furnish the necessary materials to complete the following bid package(s) / specification section(s) in its entirety. All materials shall be in accordance with the requirements of the Contract.

ITEM NO.	QUANTITY	ITEM DESCRIPTION	UNIT PRICE	TOTAL
		Bid Package(s):	L. S.	
		Specification Section(s):	L. S.	
		SPECIMEN COPY ONLY		

# TERMS & CONDITIONS OF PURCHASE ORDER

- 1. Drawings, catalogs, cut sheets, or samples shall be submitted for approval.
- 2. All invoices shall be sent to the contractor/subcontractor designated on the purchase order for approval. No invoices shall be sent directly to the Board of Education (Owner) for payment.
- 3. All invoices shall reference the purchase order number.
- 4. No change in, modification of, or revision of this order shall be valid unless in writing and signed by the Owner.
- 5. Vendor agrees to observe and comply with all applicable federal, state and locals laws, rules, ordinances and regulations in performance of this order.
- 6. Vendor shall not assign this order or any right hereunder without first having obtained the written consent of the Owner.
- 7. Deliveries are to be made in accordance with the Owner's schedule, as directed by the General Contractor (GC), Construction Manager (CM) or Qualified Provider (QP).
- 8. The Owner may cancel this purchase order in whole or in part in the event that the vendor fails or refuses to deliver any of the items purchased, within the time provided, or otherwise violates any of the conditions of this purchase order, or if it becomes evident that the vendor is not providing materials in accordance with the specifications or with such diligence as to permit delivery on or before the delivery date.
- 9. The vendor agrees to deliver the items to the supplied hereunder free and clear of all liens, encumbrances and claims.
- 10. If any of the goods covered under this purchase order are found to be defective in material or workmanship, or otherwise not in conformity with the requirements of this order, the Owner, in addition to the other rights which it may have under warranty or otherwise, shall have the right to reject the same or require that such articles or materials be corrected or replaced promptly with satisfactory materials or workmanship.
- 11. By acknowledging receipt of this order, by performing the designated work or any portion thereof, or by shipping the designated goods, the vendor agrees to the terms and conditions outlined.
- 12. This purchase order shall be governed in all respects by the laws of the Commonwealth of Kentucky.
- 13. In the event the quantities of materials supplied via this purchase order are insufficient to complete the work, the GC, CM or QP shall, at no expense to the Owner, provide such materials as necessary to complete the work.
- 14. In the event that at the completion of the work the vendor has not submitted invoices totaling the value of this purchase order, this purchase order shall be considered complete and closed.

# Kentucky Department of Education Version of Markov Ala Document A232<sup>™</sup> – 2009

General Conditions of the Contract for Construction, Construction Manager as Adviser Edition



This version of AIA Document A232<sup>™</sup>–2009 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A232–2009 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A232–2009 showing additions and deletions by the Kentucky Department of Education is available for review on the Kentucky Department of Education Web site.

Cite this document as "AIA Document A232<sup>™</sup>–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition — KDE Version," or "AIA Document A232<sup>™</sup>–2009 — KDE Version."

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# Kentucky Department of Education Version of MAIA Document A232™ – 2009

**General Conditions of the Contract for Construction,** Construction Manager as Adviser Edition

## for the following PROJECT:

(Name, and location or address) BRECKINRIDGE COUNTY AREA TECHNOLOGY CENTER ADDITION AND RENOVATION HARNED, KENTUCKY

## THE CONSTRUCTION MANAGER:

(Name, legal status and address) CODELL CONSTRUCTION COMPANY 4475 ROCKWELL ROAD WINCHESTER, KY 40391

# THE OWNER:

(Name, legal status and address)

BRECKINRIDGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD HARDINSBURG, KY 40143

## THE ARCHITECT:

(Name, legal status and address) SHERMAN CARTER BARNHART 2405 HARRODSBURG ROAD LEXINGTON, KY 40504

# **TABLE OF ARTICLES**

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT AND CONSTRUCTION MANAGER
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS
- 12 UNCOVERING AND CORRECTION OF WORK
- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

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

This document is intended to be used in conjunction with KDE versions of AIA Documents A132<sup>™</sup>–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132<sup>™</sup>–2009, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132<sup>™</sup>–2009, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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1

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1

INDEX

(Topics and numbers in **bold** are section headings.)

Acceptance of Nonconforming Work 9.6.6, 9.9.3, 12.3 Acceptance of Work 9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3 Access to Work 3.16, 6.2.1, 12.1 **Accident Prevention** 10 Acts and Omissions 3.2.1, 3.2.2, 3.3.2, 3.12.8, 3.18, 8.3.1, 9.5.1, 10.1, 10.2.5, 13.4.2, 13.7 Addenda 1.1.1, 3.11, 4.2.14 Additional Costs, Claims for 3.2.4, 3.7.4, 3.7.5, 6.1.1, 7.3, 9.10.3, 9.10.4, 10.3, 10.4, 15.1.4 Additional Inspections and Testing 4.2.8, 12.2.1, 13.5 Additional Insured 11.1.4 Additional Time, Claims for 3.7.4, 3.7.5, 6.1.1, 7.3, 8.3, 10.3 **Administration of the Contract** 3.10, 4.2 Advertisement or Invitation to Bid 1.1.1 Aesthetic Effect 4.2.19 Allowances 3.8, 7.3.8 All-risk Insurance 11.3.1, 11.3.1.1 **Applications for Payment** 4.2.7, 4.2.15, 7.3.9, 9.2, 9.3, 9.4, 9.5.1, 9.7, 9.8.3, 9.10.1, 9.10.3, 9.10.5, 11.1.3, 14.2.4 Approvals 2.1.1, 2.2.2, 2.4, 3.1.4, 3.10.1, 3.10.2, 3.12.4 through 3.12.10, 3.13.2, 3.15.2, 4.2.9, 9.3.2, 13.4.2, 13.5 Arbitration 8.3.1, 11.3.10, 13.1, 15.3.2, 15.4 ARCHITECT 4 Architect, Certificates for Payment 9.4 Architect, Definition of 4.1.1 Architect, Extent of Authority 5.2, 7.1.2, 7.3.7, 7.4, 9.3.1, 9.4, 9.5, 9.8.3, 9.8.4, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.5.1, 13.5.2, 15.1.3, 15.2.1 Architect, Limitations of Authority and Responsibility 2.1.1, 3.12.8, 4.2.1, 4.2.2, 4.2.8, 4.2.13, 5.2.1, 9.6.4, 15.2

Architect's Additional Services and Expenses 2.4, 11.3.1.1, 12.2.1, 12.2.4, 13.5.2 Architect's Administration of the Contract 4.2, 9.4, 9.5, 15.2 Architect's Approvals 3.12.8 Architect's Authority to Reject Work 4.2.8, 12.1.2, 12.2.1 Architect's Copyright 1.5 Architect's Decisions 4.2.8, 7.3.9, 7.4, 8.1.3, 8.3.1, 9.2, 9.4, 9.5, 9.8.3, 9.9.2, 13.5.2, 14.2.2, 14.2.4, 15.2 Architect's Inspections 3.7.4, 4.2, 9.8.3, 9.9.2, 9.10.1, 13.5 Architect's Instructions 3.2.4, 7.4, 9.4 Architect's Interpretations 4.2.8, 4.2.17, 4.2.18 Architect's On-Site Observations 4.2.2, 9.4, 9.5.1, 9.10.1, 12.1.1, 12.1.2, 13.5 Architect's Project Representative 4.2.16 Architect's Relationship with Contractor 1.1.2, 1.5, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.9.2, 3.9.3, 3.10, 3.11, 3.12.8, 3.16, 3.18, 4.2, 5.2, 6.2.2, 8.2, 11.3.7, 12.1, 13.5 Architect's Relationship with Construction Manager 1.1.2, 9.3 through 9.10, 10.3, 13.5.1, 10.3, 11.3.7, 13.4.2, 13.5.4 Architect's Relationship with Subcontractors 1.1.2, 4.2.8, 5.3, 9.6.3, 9.6.4 Architect's Representations 9.4, 9.5, 9.10.1 Architect's Site Visits 4.2.2, 9.4, 9.5.1, 9.8.3, 9.9.2, 9.10.1, 13.5 Asbestos 10.3.1 Attorneys' Fees 3.18.1, 9.10.2, 10.3.3 Award of Other Contracts 6.1.1, 6.1.2 Award of Subcontracts and Other Contracts for Portions of the Work 5.2 **Basic Definitions** 1.1 **Bidding Requirements** 1.1.1, 5.2.1, 11.4.1 **Binding Dispute Resolution** 9.7, 11.3.9, 11.3.10, 13.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.4.1 **Boiler and Machinery Insurance** 11.3.2 **BONDS, INSURANCE AND** 11 Bonds, Lien 7.3.7.4, 9.10.3

2

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**Completion**, Substantial 4.2.15, 8.1.1, 8.1.3, 8.2.3, 9.4.3.3, 9.8, 9.9.1, 9.10.3, 12.2.1, 12.2.2, 13.7 **Concealed or Unknown Conditions** 3.7.4, 4.2.8, 8.3.1, 10.3 Conditions of the Contract 1.1.1 **Consolidation or Joinder** 15.4.4 **CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS** 1.1.4.6 Construction Change Directive, Definition of 7.3.1 **Construction Change Directives** 1.1.1, 3.4.2, 3.12.8, 4.2.12, 4.2.13, 7.1.1, 7.1.2, 7.1.3, 7.3, 9.3.1.1 Construction Manager, Building Permits 2.2.2 Construction Manager, Communications through 4.2.6 Construction Manager, Construction Schedule 3.10.1, 3.10.3 **CONSTRUCTION MANAGER** 4 Construction Manager, Definition of 4.1.2 Construction Manager, Documents and Samples at the Site 3.11 Construction Manager, Extent of Authority 3.12.7, 3.12.8, 4.1.3, 4.2.1, 4.2.4, 4.2.5, 4.2.9, 7.1.2, 7.2, 7.3.1, 8.3, 9.3.1, 9.4.1, 9.4.2, 9.4.3, 9.8.2, 9.8.3, 9.8.4, 9.9.1, 12.1, 12.2.1, 14.2.2, 14.2.4 Construction Manager, Limitations of Authority and Responsibility 4.2.5, 4.2.8, 13.4.2 Construction Manager, Submittals 4.2.9 Construction Manager's Additional Services and Expenses 12.2.1 Construction Manager's Administration of the Contract 4.2, 9.4, 9.5 Construction Manager's Approval 2.4, 3.10.1, 3.10.2 Construction Manager's Authority to Reject Work 4.2.8, 12.2.1 Construction Manager's Decisions 7.3.7, 7.3.9, 9.4.1, 9.5.1 Construction Manager's Inspections 4.2.8, 9.8.3, 9.9.2 Construction Manager's On-Site Observations 9.5.1

3

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Contractor, Definition of 3.1.1 **Contractor's Construction Schedules** 3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.5.2 Contractor's Employees 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1 **Contractor's Liability Insurance** 11.1 Contractor's Relationship with Other Contractors and **Owner's Own Forces** 3.12.5, 3.14.2, 4.2.6, 6, 11.3, 12.1.2, 12.2.4 Contractor's Relationship with Subcontractors 1.2.2, 3.3.2, 3.18, 5, 9.6.2, 9.6.7, 9.10.2, 11.3.1.2, 11.3.7, 11.3.8, 14.2.1.2 Contractor's Relationship with the Architect 1.1.2, 1.5, 3.2.2, 3.2.3, 3.2.4, 3.4.2, 3.5, 3.7.4, 3.10.1, 3.11, 3.12, 3.16, 3.18, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3.7, 12, 13.5, 15.1.2, 15.2.1 Contractor's Relationship with the Construction Manager. 1.1.2, 3.2.2, 3.2.3, 3.3.1, 3.5, 3.10.1, 3.10.2, 3.10.3, 3.11, 3.12.5, 3.12.7, 3.12.9, 3.12.10, 3.13.2, 3.14.2, 3.15.1, 3.16, 3.17, 3.18.1, 4.2.4, 4.2.5, 5.2, 6.2.1, 6.2.2, 7.1.2, 7.3.5, 7.3.7, 7.3.10, 8.3.1, 9.2, 9.3.1, 9.4.1, 9.4.2, 9.8.2, 9.9.1, 9.10.1, 9.10.2, 9.10.3, 10.1, 10.2.6, 10.3, 11.3.7, 12.1, 13.5.1, 13.5.2, 13.5.3, 13.5.4 Contractor's Representations 3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2 Contractor's Responsibility for Those Performing the Work 3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8 Contractor's Review of Contract Documents 3.2 Contractor's Right to Stop the Work 9.7 Contractor's Right to Terminate the Contract 14.1 Contractor's Submittals 3.10.2, 3.11, 3.12, 4.2.9, 9.2, 9.3, 9.8.2, 9.9.1, 9.10.2, 9.10.3, 11.1.3, 11.4.2 Contractor's Superintendent 3.9, 10.2.6 Contractor's Supervision and Construction Procedures 1.2.2, 3.3, 3.4, 4.2.5, 4.2.7, 6.1, 6.2.4, 7.1.3, 7.3.5, 7.3.7, 8.2, 10, 12, 14, 15.1.3 Contractual Liability Insurance 11.1.1.8, 11.2, 11.3.1.5 Coordination and Correlation 1.2, 3.2, 3.3.1, 3.10, 3.12.6, 6.1.2, 6.2.1 Copies Furnished of Drawings and Specifications 1.5, 2.2.5, 3.11 Copyrights 1.5, 3.17 **Correction of Work** 2.3, 2.4, 9.4.1, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, 12.2

4

Init.

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Emergencies 10.4, 14.1.1.2, 15.1.4 Employees, Contractor's 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.1, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.1.1, 11.3.7, 14.1, 14.2.1.1 Equipment, Labor, Materials and or 1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12.2, 3.12.3, 3.13.1, 3.15.1, 4.2.8, 4.2.7, 5.2.1, 6.2.1, 7.3.7, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.2 Execution and Progress of the Work 1.1.3, 1.2.1, 1.2.2, 2.2.3, 2.2.5, 3.1, 3.3.1, 3.4.1, 3.5, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.5, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.2, 14.2, 14.3.1, 15.1.3 Extensions of Time 3.2.4, 3.7.4, 5.2.3, 7.2.3, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.5, 15.2.5 **Failure of Payment** 9.5.1.3, 9.7, 13.6, 14.1.1.3, 14.1.3, 14.2.1.2, 15.1.4 Faulty Work (See Defective or Nonconforming Work) **Final Completion and Final Payment** 4.2.1, 4.2.15, 9.8.2, 9.10, 11.1.2, 11.1.3, 11.3.1, 11.3.5, 12.3, 15.2.1 Financial Arrangements, Owner's 2.2.1GENERAL PROVISIONS 1 **Governing Law** 13.1 Guarantees (See Warranty and Warranties) **Hazardous Materials** 10.2.4, 10.3 Identification of Contract Documents 121 Identification of Subcontractors and Suppliers 5.2.1Indemnification 3.18, 9.10.2, 10.3.3, 10.3.5, 10.3.6, 11.3.1.2, 11.3.7 Information and Services Required of the Owner 2.1.2, **2.2**, 4.2.6, 6.1.2, 6.2.5, 9.6.1, 9.6.4, 9.8, 9.9.1, 9.10.3, 10.3.2, 10.3.3, 11.2, 11.3.4, 13.5.1, 13.5.2, 14.1.1.4, 14.1.3, 15.1.2 **Initial Decision** 15.2 Initial Decision Maker, Definition of 1.1.8 Initial Decision Maker, Extent of Authority 14.2.2, 14.2.4, 15.1.3, 15.2.2, 15.2.3, 15.2.4, 15.2.5 Injury or Damage to Person or Property 3.18.1, 10.2.1, 10.2.2, 10.2.8, 10.3, 10.3.3, 10.4, 11.1.1 Inspections 3.1.3, 3.7.1, 4.2.2, 9.8.2, 9.9.2, 9.10.1, 13.5 Instructions to Bidders 1.1.1 Instructions to the Contractor 3.1.4, 3.3.3, 3.7.1, 4.2.4, 5.2.1, 7, 8.2.2, 12.1, 13.5.2 Instruments of Service, Definition of 1.1.7, 1.5, 1.6

5

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Material Suppliers 1.5.1, 1.5.2, 3.12, 4.2.6, 4.2.8, 9.3.1, 9.3.1.2, 9.3.3, 9.5.3, 9.6.4, 9.6.5, 9.6.7, 9.10.5, 11.3.1 Materials, Hazardous 10.2.4. 10.3 Materials, Labor, Equipment and 1.1.3, 1.1.6, 1.5.1, 1.5.2, 3.4, 3.5, 3.8.2, 3.8.3, 3.12.2, 3.12.3, 3.12.6, 3.12.10, 3.13.1, 5.2.1, 6.2.1, 9.3.1, 9.3.2, 9.3.3, 9.5.1, 9.5.3, 9.6.4, 9.6.5, 9.6.7, 9.10.2, 9.10.5, 10.2.1, 10.2.4, 10.3 Means, Methods, Techniques, Sequences and Procedures of Construction 3.3.1, 3.12.10, 4.2.5, 4.2.11 Mechanic's Lien 2.1.2, 15.2.8 Mediation 8.3.1, 10.3.5, 15.2.1, 15.2.5, 15.2.6, 15.3, 15.4.1 **Minor Changes in the Work** 1.1.1, 3.12.8, 4.2.13, 7.1, 7.4 MISCELLANEOUS PROVISIONS 13 Modifications, Definition of 1.1.1Modifications to the Contract 1.1.1, 1.1.2, 3.11, 4.1.3, 4.2.14, 5.2.3, 7, 11.3.1 **Mutual Responsibility** 6.2 Nonconforming Work, Acceptance of 9.4.3, 9.8.3, 12.3 Nonconforming Work, Rejection and Correction of 2.3, 2.4, 3.2.3, 3.7.3, 9.4.3.3, 9.8.2, 9.8.3, 9.9.1, 11.1.1, 12.2.2.1, 12.2.3, 12.2.4, 12.2.5 Notice 1.5, 2.1.2, 2.2.1, 2.4, 3.2.4, 3.3.1, 3.7.1, 3.7.2, 3.7.5, 3.9.2, 3.12.9, 5.2.1, 6.3, 9.4.1, 9.7, 9.10.1, 9.10.2, 10.2.2, 10.2.6, 10.2.8, 10.3.2, 11.3.6, 12.2.2.1, 13.3, 13.5.1, 13.5.2, 14.1.2, 14.2.2, 14.4.2, 15.1.2, 15.1.4, 15.1.5.1, 15.2, 15.4.1 Notice of Claims 3.7.2, 10.2.8, 15.1.2, 15.4.1 Notice of Testing and Inspections 13.5.1, 13.5.2 Notices, Permits, Fees and 3.7, 7.3.7, 10.2.2 Observations, On-Site 3.2.1, 9.5.1, 12.1.1 Occupancy 2.2.2, 9.6.6, 9.9, 11.3.1.5 **On-Site Inspections** 4.2.2, 9.10.1, 9.4.4, 9.5.1 Orders, Written 4.2.7, 4.2.18, 4.2.20 Other Contracts and Contractors 1.1.4, 3.14.2, 4.2.9, 6, 11.3.7, 12.1.2 **OWNER** 2 Owner, Definition of 2.1.1

6

init.

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PCB 10.3.1 Performance Bond and Payment Bond 5.4.1, 7.3.7, 9.6.7, 9.10.2, 9.10.3, 11, 11.4 Permits, Fees, Notices and Compliance with Laws 2.2.2, 3.7, 7.3.7.4, 10.2.2 PERSONS AND PROPERTY, PROTECTION OF 10 Polychlorinated Biphenyl 10.3.1 Product Data, Definition of 3.12.2 **Product Data and Samples, Shop Drawings** 3.11, 3.12, 4.2.9, 4.2.10, 4.2.14 **Progress and Completion** 8.2, 9.3.1, 9.4.2, 9.6, 9.8, 9.10, 14.2.4, 15.1.6 **Progress Payments** 9.3.1. 9.4.2. 9.6 **Project**, Definition of 1.1.4 **Project Representatives** 4.2.16 **Property Insurance** 10.2.5, 11.3 Project Schedule 3.10.1, 3.10.3, 3.10.4, 4.2.2, 4.2.3, 4.2.4 PROTECTION OF PERSONS AND PROPERTY 10 **Regulations and Laws** 1.5, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 4.1.1, 9.6.4, 9.9.1, 10.2.2, 11.1, 11.4, 13.1, 13.4, 13.5.1, 13.5.2, 13.6, 14.1.1, 14.2.1, 15.2.8, 15.4 **Rejection of Work** 3.5, 4.2.8, 12.2.1 Releases of and Waivers and of Liens 9.10.2 Representations 1.3, 2.2.1, 3.5, 3.12, 6.2.2, 8.2.1, 9.3.3, 9.4.3, 9.5.1, 9.8.2, 9.10.1 Representatives 2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.1, 4.2.2, 4.2.10, 5.1.1, 5.1.2, 13.2.1 **Requests for Information** 4.2.20 Resolution of Claims and Disputes 15 Responsibility for Those Performing the Work 3.3.2, 3.7.3, 3.12.8, 3.18, 4.2.2, 4.2.5, 4.2.8, 5.3, 6.1.2, 6.2, 6.3, 9.5.1, 9.8.2, 10 Retainage 9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3 **Review of Contract Documents and Field Conditions by Contractor** 1.2.2. 3.2, 3.7.3, 3.12.7 Review of Contractor's Submittals by Owner, **Construction Manager and Architect** 3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 5.2, 9.2, 9.8.2

7

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8

Init.

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Waiver of Claims by the Architect 13.4.2 Waiver of Claims by the Construction Manager 13.4.2 Waiver of Claims by the Contractor 9.10.5, 13.4.2, 15.1.6 Waiver of Claims by the Owner 9.9.3. 9.10.3, 9.10.4, 12.2.2.1, 13.4.2, 14.2.4, 15.1.6 Waiver of Consequential Damages 14.2.4, 15.1.6 Waiver of Liens 9.10.2, 9.10.4 Waivers of Subrogation 6.1.1, 11.3.7 Warranty 3.5, 4.2.15, 9.3.3, 9.8.4, 9.9.1, 9.10.4, 12.2.2, Weather Delays 15.1.5.2 Work, Definition of 1.1.3 Written Consent 1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.3, 9.3.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 10.3.2, 11.4.1, 13.2, 13.4.2, 15.4.4.2 Written Interpretations 4.2.17, 4.2.18 Written Notice 2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 5.3, 5.4.1.1, 8.2.2, 9.4, 9.5.1, 9.7, 9.10, 10.2.2, 10.3, 11.1.3, 12.2.2, 12.2.4, 13.3, 13.5.2, 14, 15.4.1 Written Orders 1.1.1, 2.3, 3.9, 7, 8.2.2, 12.1, 12.2, 13.5.2, 14.3.1, 15.1.2

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

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager's consultants, (5) between the Construction or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their 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 other Multiple Prime Contractors and by the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

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

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

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

§ 1.1.8 Initial Decision Maker. The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.1.9 Definitions. Wherever used in these General Conditions or in other contract documents, the following terms have the meaning indicated which are applicable to both the singular and plural thereof:

- .1 "Provide" as used through the specifications shall mean furnish, install, and pay for.
- 2 "Furnish" means supply and deliver to project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance, except as otherwise defined in greater detail.
- .3 "Install" means, except as otherwise defined in greater detail, to describe operations at project site including unloading, storage, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, furnishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
- .4 "Installer" means the entity (person or firm) engaged by Contractor or its subcontractor for performance of a particular unit of work at project site, including installation, erection, application and similar

Init.

required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

- .5 "Owner Furnished-Contractor Installed (OFCI)" means equipment or components of a system that are purchased by the Owner and furnished to the Contractor for installation in the project. The Contractor shall receive, store, protect, install, connect, and test each item unless otherwise indicated.
- .6 "Contractor Furnished-Contractor Installed (CFCI)" means equipment or components of a system that are purchased, furnished, and installed by the Contractor.
- .7 "Owner Furnished-Owner Installed (OFOI)" means equipment or components of a system that are purchased, furnished, and installed by the Owner or his vendors.
- .8 "Material Supplier" means a person or organization who has a direct Purchase Order responsibility to the Owner. Purchase Order amount as bid shall include all costs of delivery to the job site. Material Supplier assumes all responsibility for materials until delivery is accepted by the Owner. Material Supplier shall guarantee all materials furnished under a purchase order to be in accordance with the requirements of the contract documents. This guarantee shall extend through the construction period and one (1) year from the date of substantial completion upon final acceptance by the Owner of the Project. The designated Contractor or Subcontractor responsible for installation of Purchase Order material or equipment shall supervise and accept delivery, unload, handle, store, layout and install the items. Upon delivery, the designated contractor shall verify product suitability, quantity, quality and condition as soon as it can be ascertained and shall accept care, custody and control responsibility as if it were his own purchase. Any damage or loss after acceptance will be the responsibility of the designated contractor.

## § 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. The Contractor shall make a thorough examination of the site and study all drawings and specifications and all conditions relating to the erection of the work and if any materials or labor evidently necessary for the proper and complete execution of the work, which are not specifically mentioned although reasonably inferred therefrom, shall be included in the work. In the event of a doubt arising as to the true intent and meaning of the drawings or specifications, the Contractor shall report it at once to the Architect. The Architect shall furnish with reasonable promptness, additional instructions, by means of drawings or otherwise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the contract documents, true developments thereof and reasonably inferable therefrom. The work shall be executed in conformity therewith and the Contractor shall do no work without proper drawings and instructions. If the Contractor proceeds contrary to the above instructions, all such labor and material costs shall be provided at the Contractor's expense. Should any inconsistency appear in the Drawings or Specifications, the Contractor, before proceeding with the work must make mention of the same to the Architect for proper interpretation, and in no case proceed with the work in uncertainty or with insufficient drawings.

§ 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.

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# § 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect, or Architect's consultants' reserved rights.

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

# § 1.6 Transmission of Data in Digital Form

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

## ARTICLE 2 OWNER

## § 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Article 4, the Construction Manager and the Architect do 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.

§ 2.1.3 All notices (relating to any part of this contract) to Contractors from the Owner shall be in writing and considered delivered and the service thereof completed, when the notice is posted, by registered mail, to the Contractor at his last address or delivered in person to the Contractor or his authorized representative on the Project.

# § 2.2 Information and Services Required of the Owner § 2.2.1 (Not Used)

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

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

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

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

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§ 2.2.6 The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents.

# § 2.3 Owner's Right to Stop the Work

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

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

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

# **ARTICLE 3 CONTRACTOR**

# § 3.1 General

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

§ 3.1.2 The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

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

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

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

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor of 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 Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and 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 make 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 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, unless the Contract Documents give other specific instruction concerning these matters. If the Contract Documents give specific instructions concerning there of and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures that such means, the Construction Manager, and the Architect and shall not proceed with that portion of the Work without further written instructions from the Architect, through the Construction Manager. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences.

§ 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 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 the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

# § 3.4 Labor and Materials

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

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

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

# § 3.5 Warranty

The Contractor warrants to the Owner, Construction Manager, 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 with 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

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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 Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

# § 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof 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 Owner, through the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay 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, Construction Manager, and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect and Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may proceed as provided in Article 15.

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

# § 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

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Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly .3 by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

## § 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect through the Construction Manager, the name and qualifications of a proposed superintendent. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager, or the Architect has reasonable objection to the proposed superintendent or (2) that any of them require additional time to review. Failure of the Construction Manager to reply 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, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

# § 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces.

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

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project schedule.

# § 3.11 Documents and Samples at the Site

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

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# § 3.12 Shop Drawings, Product Data and Samples

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.9 through 4.2.11. Informational submittals upon which the Construction Manager and Architect are 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 Construction Manager or Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Construction Manager Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the Project submittal schedule approved by the Construction Manager and Architect, or in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Multiple Prime Contractors or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Multiple Prime Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner, Construction Manager, 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 reviewed and approved by the Architect.

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design

professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

#### § 3.13 Use of Site

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

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

# § 3.14 Cutting and Patching

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Multiple Prime Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner's own forces or by other Multiple Prime Contractors except with written consent of the Construction Manager, Owner and such other Multiple Prime Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Multiple Prime Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 Cleaning Up

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

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, 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, Construction Manager and Architect access to the Work in preparation and progress wherever located.

# § 3.17 Royalties, Patents and Copyrights

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

## § 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and 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,

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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 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 AND CONSTRUCTION MANAGER § 4.1 General

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

§ 4.1.2 The Owner shall retain a construction manager lawfully licensed to practice construction management or an entity lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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

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

# § 4.2 Administration of the Contract

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§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and 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. On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner and Construction Manager (1) known deviations from the Contract Documents and from the most recent Project schedule prepared by the Construction Manager, and (2) defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide a staffing plan to include one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner reasonably informed of the progress of the Work, and will report to the Owner and Architect (1) known deviations from the Contract Documents and the most recent Project schedule, and (2) defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Multiple Prime Contractors in accordance with the latest approved Project schedule. The Construction Manager will establish an overall construction schedule based on the milestone dates. A copy of the schedule shall be displayed at the Project site. The Construction Manager shall update this schedule periodically if required and establish new milestone dates. It shall be each Contractor's responsibility to keep advised of the current schedule and the effects upon his work.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Multiple Prime Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. The Construction Manager shall determine in general whether the Work of the Contractor is being performed in accordance with the requirements of the Contract Documents and notify the Owner, Contractor and Architect of defects and deficiencies in the Work. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data and Samples. Where there are Multiple Prime Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from Contractor and other Multiple Prime Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.10 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. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.11 Review of the Contractor's submittals by the Construction Manager and Architect 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

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1

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20

responsibility of the Contractor as required by the Contract Documents. The Construction Manager and 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 Construction Manager and Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Construction Manager and Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.12 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.13 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7. and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.14 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.15 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.16 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

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

§ 4.2.18 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 so rendered in good faith.

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

§ 4.2.20 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

# ARTICLE 5 SUBCONTRACTORS

# § 5.1 Definitions

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

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21

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

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

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

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager 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, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

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

# § 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager 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 Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

# § 5.4 Contingent Assignment of Subcontracts

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

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

22

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.

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§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. 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 OTHER CONTRACTORS

# § 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

 $\S$  6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

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

## § 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Construction Manager and other Multiple Prime 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's own forces or other Multiple Prime Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's own forces or other Multiple Prime Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a separate contractor or to other Multiple Prime Contractors 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 delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces or other Multiple Prime Contractors.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner, separate contractors, or other Multiple Prime Contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and other Multiple Prime Contractors 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, other Multiple Prime 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 Construction Manager, with notice to 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, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

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

§ 7.1.4 A proposed Change in the Work equal to or exceeding \$25,000, additive or deductive, shall be subject to approval by the Kentucky Department of Education prior to execution of the Change Order by the Owner.

# § 7.2 Change Orders

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

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

# § 7.3 Construction Change Directives

§7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager 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:

- Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to .1 permit evaluation;
- Unit prices stated in the Contract Documents or subsequently agreed upon; .2
- Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or .3 percentage fee; or
- As provided in Section 7.3.7. .4

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

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

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the method and the adjustment on the basis of reasonable expenditures and

24

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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 Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and 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 Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The 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 Construction Manager and 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 Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

# § 7.4 Minor Changes in the Work

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor.

# ARTICLE 8 TIME

# § 8.1 Definitions

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

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

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

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

# § 8.2 Progress and Completion

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

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

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

## § 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner, Owner's own forces, Construction Manager, Architect, any of the other Multiple Prime Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration, or by other causes that the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the Contract Time shall be extended by Change Order 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.

#### § 8.4 Liquidated Damages

§ 8.4.1 If the Contractor fails to substantially complete Work to be performed under the Contract by and at applicable Contract Time, including any extension of time granted under General Conditions, and as actual damages for delay in completion of Work are impossible to determine, the Contractor and his Surety shall be liable for and shall pay to the Owner the sum of

), not as a penalty, but as fixed, agreed and liquidated damages for each calendar day of delay until (\$ the Contract Work is substantially completed as defined herein. The Owner shall have the right to deduct liquidated damages from money in hand otherwise due, or to become due, to the Contractor, or to sue and recover compensation for damages for failure to substantially complete the Work within the time stipulated herein. Said liquidated damages shall cease to accrue from the date of Substantial Completion.

§ 8.4.2 The Contractor shall not be charged with liquidated damages or any excess cost when delay in completion of the work is due

- to any preference, priority or allocation order duly issued by the government; .1
- to unforeseeable cause beyond the control and without the fault or negligence of the Contractor, .2 including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather;
- to any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections .3 (.1) or (.2) of this Section.

§ 8.4.3 When the conditions of Section 8.4.2 apply, the Contractor shall, within fifteen (15) days of the occurrence of the delay event, notify the Architect and Construction Manager in writing. Notice of the extent of the claim with supporting data shall be delivered to the Architect and Construction Manager within forty-five (45) days of such occurrence. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order. In no event shall any delays or extensions of time be construed as cause or justification for payment of extra compensation to the Contractor.

# ARTICLE 9 PAYMENTS AND COMPLETION

#### § 9.1 Contract Sum

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

#### § 9.2 Schedule of Values

Where the Contract is based on a Stipulated Sum, the Contractor shall submit to the Construction Manager, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. In the event there is one Contractor, the Construction Manager shall forward to the Architect the Contractor's schedule of values. If there are Multiple Prime Contractors

responsible for performing different portions of the Project, the Construction Manager shall forward the Multiple Prime Contractors' schedules of values only if requested by the Architect.

# § 9.3 Applications for Payment

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager 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. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 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 Construction Manager and Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material 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, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

# § 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there are Multiple Prime Contractors performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives the Multiple Prime Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Multiple Prime Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Multiple Prime Contractors; application with information from similar applications for progress payments from other Multiple Prime Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Multiple Prime Contractors; and (5) forward the Summary of Contractors' Application and Certificate for Payment to the Architect.

§ 9.4.3 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's

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§ 9.4.4 The Construction Manager's certification of an Application for Payment or, in the case of Multiple Prime Contractors, a Project Application and Certificate for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

§ 9.4.5 The Architect's issuance of a Certificate for Payment or in the case of Multiple Prime Contractors, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

**§ 9.4.6** The representations made pursuant to Sections 9.4.4 and 9.4.5 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 Construction Manager or Architect.

§ 9.4.7 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

## § 9.5 Decisions to Withhold Certification

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 $\tilde{\S}$  9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.3. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

§ 9.5.3 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment

28

suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

## § 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project 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 Construction Manager and 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 Construction Manager 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 Owner, Construction Manager and Architect 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 material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

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

.1 A Material Supplier with Owner direct Purchase Orders can be paid by one payment by the Owner upon satisfactory completion of the requirements of the Purchase Order, which would include the delivery of materials and satisfactory verification that the materials comply with requirements of the Contract Documents.

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

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

§ 9.6.8 When Owner direct Purchase Orders are used, retainage that would otherwise be held on materials and equipment shall transfer to the Contractor, and the material suppliers will be paid the full amount of their invoices. The Owner shall retain ten percent (10%) from each Application for Payment, and an amount equal to ten percent (10%) of approved Purchase Order payments, up to fifty percent (50%) completion of the Work, then provided the Work is on schedule and satisfactory, and upon written request of the Contractor together with consent of surety and the recommendation of the Architect, the Owner shall approve a reduction in Retainage to five percent (5%) of the current Contract Sum plus Purchase Orders. No part of the five percent (5%) retainage shall be paid until after Substantial Completion of the Work, as defined in the General Conditions of the Contract for Construction. After Substantial Completion, if reasons for reduction in retainage are certified in writing by the Architect, a reduction to a lump sum amount less than the five percent (5%) retainage may be approved by the Owner when deemed reasonable. The minimum lump sum retainage shall be twice the estimated cost to correct deficient or incomplete work.

#### § 9.7 Failure of Payment

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If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen days after the Construction Manager's 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 Construction Manager and Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

## § 9.8 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 the Owner can occupy or utilize the Work for its intended use. The ability to occupy and utilize the Work or designated portion thereof shall require an occupancy permit issued by the Kentucky Department of Housing, Building, and Construction and any other agencies that have statutory authority and approval requirements.

§ 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 notify the Construction Manager, and the Contractor and Construction Manager shall jointly 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 list, the Architect, assisted by the Construction Manager, 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 list, which is not sufficiently complete in accordance with the requirements of 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, assisted by the Construction Manager, to determine Substantial Completion.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute a Certificate of Substantial Completion (AIA Document G704CMa) that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

#### § 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 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 and Construction Manager shall jointly 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 after consultation with the Construction Manager.

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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 completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will evaluate the completion of Work of the Contractor and then forward the notice and Application, with the Construction Manager's recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project 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.

.1 Upon receipt and approval of the final Application for Payment, for each Contract and Purchase Order, if any, the Construction Manager will prepare, and the Construction Manager, Architect, and Owner shall complete their portion of the Kentucky Department of Education BG-4 Contract Closeout Form – 2013, and forward the board-approved BG-4 form to the Kentucky Department of Education with a copy of the final Certificate for Payment upon the Board authorizing the BG-4 form, accepting the Work, and approving final payment to the Contractor or Material Supplier.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. 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. If such lien 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 such lien, 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 Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager 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; or
- .3 terms of special warranties required by the Contract Documents.

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31

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

# ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

#### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors.

The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

## § 10.2 Safety of Persons and Property

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

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

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

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

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 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, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any 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, Construction Manager and Architect.

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

# § 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not

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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

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

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a 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, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager 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 in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their 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 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 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 indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 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 indemnify 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 Liability Insurance

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. Such insurance shall be no less than the following amounts:

(1) Public Liability	\$200,000.00 one person/maximum each person \$500,000.00 one accident/maximum each person
(2) Property Damage	\$200,000.00 one accident/maximum \$500,000.00 aggregate

§ 11.1.2.1 The insurance required by Section 11.1.1 shall be written for not less than the following limits, or greater if required by law:

(1)	Worker's Compensation:	
(-)	a. State	Statutory
	b. Applicable Federal (e.g., Longshoreman's)	Statutory
	c. Employer's Liability	\$500,000

 Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractor's Protection; Product Liability and Completed Operations; Broad Form Property Damage);

and

34

a.	General Aggregate	
	(except Products-Completed Operations)	\$1,000,000
b.	Products-Completed Operations Aggregate	\$1,000,000
c.	Personal/Advertising Injury	
	(per person/organization)	\$1,000,000
d.	Each Occurrence	
	(Bodily Injury and Property Damage)	\$1,000,000
e.	Limit per Person Medical Expense	\$10,000
f.	Exclusions of Property in Contractors Care, Custody o	r Control will be eliminated.
g.	Property Damage Liability Insurance will provide Cov	erage for Explosion, Collapse,

Underground Damage.

(3) Contractual Liability:

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а.	General Aggregate	\$1,000,000
b.	Each Occurrence (Bodily Injury and Property Damage)	\$1,000,000

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Au	tomobile Liability:	
a.	Bodily Injury	\$500,000 Each Person
		\$1,000,000 Each Accident
b.	Property Damage	\$500,000 Each Accident, or a combined single limit of \$1,000,000

(5) Liability coverage for the Owner, the Architect, the Architect's Consultants and others listed in the Supplementary Conditions will be provided (subject to customary exclusions for professional liability), by endorsement as additional insured's on the Contractor's Liability Policy.

(6)	Excess Liability Umbrella Form:	
. ,	a. General Aggregate	\$1,000,000
	b. Each Occurrence	\$1,000,000

§ 11.1.2.2 There shall be an endorsement in each of the above policies reading as follows: "It is hereby agreed that in the event of a claim arising under this policy, the company may not deny liability be reason of the insured being a state, county, municipal corporation or governmental agency."

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Construction Manager, the Construction Manager's consultants, the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's negligent acts or omissions during the Contractor's completed operations.

## § 11.2 Owner's Liability Insurance

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

## § 11.3 Property Insurance

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(4)

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to

AlA Document A232<sup>™</sup> – 2009 (formerly A201<sup>™</sup>CMa – 1992). Copyright © 1992 and 2009 by The American Institute of Architects. All rights reserved. Kentucky Department of Education Version of AlA Document A232<sup>™</sup>–2009. Copyright © 2014 by The American Institute of Architects. All rights reserved. WARNING: This AlA<sup>®</sup> Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AlA<sup>®</sup> Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This document is licensed by The American Institute of Architects for one-time use only, and may not be reproduced prior to its completion. This document was created on under license number , and is not for resale. This document is licensed by The American Institute of Architects for one-time use only, and may not be reproduced prior to its completion. commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining 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, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.6.1 Before an exposure to loss may occur, the Owner shall provide the Architect and the Kentucky Department of Education with certificates of insurance coverage required by this Section 11.3.

§ 11.3.7 Waivers of Subrogation. 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, and (2) the Construction Manager, Architect, Architect's consultants, separate contractors described in Article 6, 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 covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, Owner's separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall

AlA Document A232™ – 2009 (formerly A201™CMa – 1992). Copyright © 1992 and 2009 by The American Institute of Architects, All rights reserved. Kentucky Department of Education Version of AlA Document A232™–2009. Copyright © 2014 by The American Institute of Architects. All rights reserved. WARNING: This AlA<sup>®</sup> Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AlA<sup>®</sup> Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AlA<sup>®</sup> Document is incensed by The American Institute of Architects for one-time use only, and may not be reproduced prior to its completion. This document was created on under license number , and is not for resale. This document is licensed by The American Institute of Architects for one-time use only. and may not be reproduced prior to its completion. provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance 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 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or distribution of insurance proceeds in accordance with the direction of the arbitrators.

## § 11.4 Performance Bond and Payment Bond

§ 11.4.1 Unless otherwise provided, when the Contract Sum exceeds twenty-five thousand dollars (\$25,000) the Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. A surety company authorized to do business in Kentucky shall execute bonds, and the cost thereof shall be included in the Contract Sum. Unless otherwise provided, the amount of each bond shall be equal to 100% of the Contract Sum plus Purchase Orders, or 100% of the Lump Sum Base Bid plus or minus accepted Alternates, whichever is greater.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished. The Contractor shall furnish a performance and payment bond in an amount at least equal to one hundred percent (100%) of the contract price as security for the faithful performance of the contract and the payment of all persons performing labor on the project under the contract and furnishing materials, equipment or supplies in connection with the contract, including security for the payment of all unemployment contributions which become due and payable under Kentucky Unemployment Insurance Law. The performance and payment bond (AIA Document A312-2010) shall be executed by a Surety Company authorized to do business in the Commonwealth of Kentucky, and the contract instrument of bonds must be countersigned by a duly appointed and licensed agent resident of Kentucky.

## 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 Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their observation 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 which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

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#### § 12.2 Correction of Work

## § 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and 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 an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period 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, whether completed or partially completed, of the Owner or separate contractors or other Multiple Prime Contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

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

## § 12.3 Acceptance of Nonconforming Work

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

#### ARTICLE 13 MISCELLANEOUS PROVISIONS

## § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.1.1 None of the Contract Documents for this project shall be construed against the party preparing documents on the grounds that the party prepared or drafted the document, or any portion thereof.

## § 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.

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If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 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 such assignment.

## § 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity or to an officer of the corporation for which it was intended; or if delivered at or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

## § 13.4 Rights and Remedies

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

§ 13.4.2 No action or failure to act by the Owner, Construction Manager, 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 in writing.

## § 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and 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 Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense.

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

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

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

#### § 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as required by state law, or in the absence of law, at the legal rate prevailing at the time and place where the Project is located.

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## § 13.7 Time Limits on Claims

The Owner and the Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and the Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

## § 14.1 Termination by the Contractor

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

- Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be .1 stopped;
- An act of government, such as a declaration of national emergency that requires all Work to be stopped; .2
- Because the Construction Manager has not certified or the Architect has not issued a Certificate for .3 Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable .4 evidence as required by Section 2.2.1.

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

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

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and 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

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

§ 14.2.2 When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- Exclude the Contractor from the site and take possession of all materials, equipment, tools, and .1
  - construction equipment and machinery thereon owned by the Contractor;
- Accept assignment of subcontracts pursuant to Section 5.4; and .2

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.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 Construction Manager's and 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, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, 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 the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

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

## § 14.4 Termination by the Owner for Convenience

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

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

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

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

## 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, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Notice of Claims. Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Construction Manager and or Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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§ 15.1.3 Continuing Contract Performance. Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

**§ 15.1.4 Claims for Additional Cost.** If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3.

## § 15.1.5 Claims for Additional Time

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

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

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

#### § 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, 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 arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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42

§ 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 and Construction Manager, if the Architect or Construction Manager 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 an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

## § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 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 shall be in accordance with the Construction Industry Mediation Procedures of the American Arbitration Association 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 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. 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.

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## § 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Either party, at its sole discretion, 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 Either party, at its sole discretion, 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 the Owner and Contractor under this Agreement.

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The following Supplementary Conditions modify, change, delete from or add to the KENTUCKY DEPARTMENT OF EDUCATION VERSION OF AIA A232-2009 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, CONSTRUCTION MANAGER AS ADVISOR EDITION, a copy of which is bound into the Project Manual. Where an Article of the General Conditions is modified or a Paragraph, Subparagraph, or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

## ARTICLE 1 GENERAL PROVISIONS

## 1.1.1 THE CONTRACT DOCUMENTS

Insert the following in the first sentence: "...Conditions of the Contract, Instructions to Bidders (General, Supplementary), Contractor's Form of Proposal, Project Construction Schedule...". Delete last sentence in its entirety.

## ARTICLE 2 OWNER

## 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

Delete Subparagraph 2.4. and substitute the following:

2.4. If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a three-day period after receipt of written notice from the owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate change order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Construction Manager's and Architect's and their respective consultants' additional services and expenses made necessary for such default, neglect, or failure. Such action by the owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE NO. 3 CONTRACTOR

## 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Add the following Subparagraphs:

- 3.2.5 Plans and specifications for the Project show or specify various structural, architectural, mechanical and electrical entities, diagrams, and devices for each item. The mention of acceptable manufacturer does not necessarily imply that their particular "standard" product meets all of the requirements of the detail or specifications. Therefore, the cost of deviations, extensions or adjustments required for the low Bidder's product must be included in the Contractor's bid. No additional cost will be considered.
- 3.2.6 By execution of this contract, the Contractor warrants that he has visited the site of the proposed work, and fully acquainted himself with the existing conditions there relating to construction and labor, and that he fully understands the facilities, difficulties, and restrictions attending the execution of the work under contract. The Contractor further warrants that he has thoroughly examined and is familiar with the drawings, specifications, and all other documents comprising the contract. The Contractor further warrants that by execution of this contract, his failure, when he was bidding on this contract, to receive or examine any form, instrument, or document or to visit the site and acquaint himself with conditions there existing, in no way relieves the Contractor of any liability. The Contractor agrees that the Owner shall be justified in rejecting any claim based on facts regarding conditions for which should have been on prior notice.

Before ordering material or performing any work, the Contractor shall verify all measurements at the work site. Any difference between dimensions on the Drawings and actual measurements shall be brought to the Architect's attention for his consideration before the work may proceed. No extra compensation will be allowed because of difference between actual measurements and dimensions indicated on the Drawings. The contractor shall assume full responsibility for accuracy of measurements obtained at the Work Site.

## 3.5 WARRANTY

Add the following subparagraph:

The Contractor shall also provide warranties as required by the technical specifications. Contractors and material and equipment suppliers shall be responsible for providing any additional or extended warranties and associated costs, required to provide the specified warranty period beginning from the date of Substantial Completion. (No Exceptions).

## 3.6 TAXES

Add the following subparagraph:

Bidders are informed that construction contracts of the Commonwealth of Kentucky and political subdivisions are not exempt from the provisions of the Kentucky Sales and/or Use Tax. Current sales and/or Use Tax shall be provided for and included in the bid amount as no adjustments will be permitted nor made after receipt of bids.

## 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

Add the following Subparagraphs:

- 3.7.6 "All branches of the work shown on the plans or specified shall be executed in strict compliance with all local or state regulations and codes, and shall be in compliance with all National Codes, when same have jurisdiction."
- 3.7.7 "All Contractors must be qualified, and meet all requirements provided and/or required under any local and/or state statute, code, ordinances, or rule governing the performance of the type of work of which he submits a bid, and be able to submit proof thereof upon request."

## 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

Delete Subparagraph 3.10.1 in its entirety. The Contractor is referred to Volume One, Section 01010.

## 3.15 CLEANING UP

Add the following sentence at the end of Subparagraph 3.15.1

"Clean-up shall be performed daily".

## ARTICLE NO. 5 SUBCONTRACTORS

## 5.3 SUBCONTRACTUAL RELATIONS

Add the following sentence at the end of Paragraph 5.3.

"All Subcontractors shall familiarize themselves with all of the conditions relating to this contract since the terms set forth in the General conditions binds all subcontractors to the Contract."

## ARTICLE NO. 7 CHANGES IN THE WORK

## 7.2 CHANGE ORDERS

Add the following Subparagraphs:

- A. 7.2 CHANGE ORDERS
- (1) Revise Subparagraph 7.2.2 as follows:

Between the words "Contract Sum" and "include those" delete the word "may".

(2) Add the following Subparagraph 7.2.3 with Clauses 7.2.3.1, 7.2.3.2 and 7.2.3.3 to Paragraph 7.2:

7.2.3 Changes in the Work covered by change order on a lump sum basis shall include a detailed breakdown of all costs and including a component for all overhead and

profit, indirect costs or other items not to exceed fifteen percent (15%) with overhead not to exceed ten percent (10%) and profit not to exceed five percent (5%). The Contractor shall only receive one fifteen percent (15%) mark-up as the "jobsite overhead and profit" component whether such work is done by the Contractor or by his Subcontractor. Separate amounts shall be shown for each material item, labor item, overhead and profit.

7.2.3.1 The Contractor shall keep and present a correct account of all items comprising the net cost of such Work, together with vouchers when performing work on a cost-plus basis. The cost shall include the cost to the Contractor of all materials used, of all labor including common and skilled, foremen, and trucks and teams, and the fair rental of all machinery used and for the period of such use. If such Work requires the use of machinery not already upon the Work or to be otherwise used upon the Work, then the cost of transportation of such machinery to and from the Work shall be added to the fair rental, but said transportation shall not cover a distance exceeding on hundred (100) miles.

7.2.3.2 The Contractor shall not include in the net cost of Work any cost or rental for small tools, or any portion of time of the Contractor or his superintendent, or any allowance for the use of capital, or any additional bond premium, insurance cost applicable to the Work, or any actual or anticipated profit, or any job or office overhead not previously mentioned, these being considered as being covered by the added fifteen percent (15%) for the jobsite overhead and profit component.

7.2.3.3 In all such cases where changes in the Work are covered by unit prices set forth in the Contract, the value of such Work shall be determined only upon the basis of such unit price.

(3) Add the following Subparagraph 7.2.4 to Paragraph 7.2

7.2.4 The execution of the Change Order by the Contractor shall constitute conclusive evidence of the Contractor's agreement to the ordered changes in the Work, the resulting Contract as thus amended, the Contract Sum, and the time for performance by the Contractor. The Contractor, by executing the Change Order, waives and forever releases any claim against the Owner for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order.

(4) Add the following Subparagraph 7.2.5 to Paragraph 7.2

7.2.5 The Contractor shall notify and obtain consent and approval of the Contractor's Payment and performance Bond sureties with reference to all Change Orders, if such notice, consent or approval is required by the Owner, Construction Manager, Architect, or Contractor's sureties, or by law. The Contractor's execution of the Change Order shall constitute the Contractor's warranty to the Owner that the sureties have been notified of, and consent to, such Change Order and the sureties shall be conclusively deemed to have been notified of such Change Order and to have expressly consented thereto.

B. 7.4 MINOR CHANGES IN THE WORK

(1) Add Subparagraph 7.4.2 to Paragraph 7.4:

7.4.2 If the Contractor claims that any instructions by the Architect or Construction Manager involve additional cost and / or time extension, the Contractor shall give the Construction Manager written notice thereof within time limits defined in Subparagraph

4.7.3 after receipt of such instructions or before proceeding to execute the instructions in Work, whichever is sooner. Otherwise the Contractor shall be deemed to have waived any right to claim an adjustment to the Contract Sum or to the Contract Completion Time.

## ARTICLE NO. 9 PAYMENTS AND COMPLETION

## 9.3 APPLICATIONS FOR PAYMENTS

Add the following Subparagraph to Paragraph 9.3.1

9.3.1.3"The date for each progress payment shall be established to provide sufficient time for the Construction Manager's and Architect's review and for the Owner to include the application payment in the agenda of the next regularly scheduled board meeting.

## 9.6 PROGRESS PAYMENT

Add to the front of Subparagraph 9.6.1 the following:

The Owner will make payment to the contractor by either one payment upon completion of the project and acceptance by the Owner, or the Contractor may apply for partial payments less ten percent (10%) retainage on the amount of work performed or materials furnished for the work in accordance with the conditions and the following procedures:

A. Schedules – Prior to submitting the first payment application, the Contractor shall submit a schedule of values of the work and a progress schedule in form and substance satisfactory to Construction Manager and Architect for approval. The schedule of values shall include quantities and prices aggregating the contract price and shall subdivide the work into component parts. An approved copy of the Schedules will be provided to the Contractor which will be the basis for progress payments during construction. The schedule of progress shall indicate the starting and completion dates of the various stages of work.

B. Application for Progress Payment –

(1) Not more than once a month, the Contractor shall submit to the Construction Manager a signed application for payment for the work completed as of the date of the application and accompanied by such data and schedules as the Construction Manager may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the work, but delivered and suitably stored at the site or at another location agreed to in writing, the application for payment shall also be accompanied by such data, satisfactory to the Owner, as will establish Owner's title to the material and equipment and protect the Owner's interest therein, including applicable insurance. Each subsequent application for payment shall include an affidavit from the Contractor stating that all previous progress payment received on account of the work have been applied to discharge, in full, all of the Contractor's obligations reflected in prior applications for payment.

(2) Upon certificate of substantial completion of the work, the Contractor may make application for the balance of the contract funds less a five percent (5%) retainage. Upon completion of all punch list items, the Contractor may make application for the remaining

five percent (5%) retainage.

(3) The Kentucky Fairness in Construction Act, KRS 371.400 to 371.990, applies to this construction contract, and where there is a conflict between the terms and conditions of these contract documents and the provisions of the Kentucky Fairness in Construction Act, the latter shall prevail.

## 9.10 FINAL COMPLETION AND FINAL PAYMENT

Add to the front of Subparagraph 9.10.1 the following:

"Final completion of the work" shall mean when all "punch list" items are completed, when "waiver of lien" is submitted, the manufacturers' warranties are submitted and approved, and the contractor has delivered to the Architect all required certificates of inspection. Final Completion shall include final clean-up of the building and premises.

Add the following to the end of Subparagraph 9.10.2:

"Retainage will not be reduced below five percent (5%) until all items have been worked off of the punch list.

## ARTICLE NO. 10 PROTECTION OF PERSONS AND PROPERTY

## 10.2 SAFETY OF PERSONS AND PROPERTY

Add the following Subparagraphs:

10.2.9 "CONSTRUCTION AND SAFETY DEVICES: The Contractor shall provide safety controls for protection of the life and health of employees. He will utilize precautionary methods for the prevention of damage to property, materials, equipment, and supplies, and for avoidance of work interruptions in the performance of this contract. In order to provide such safety controls aforesaid, the Contractor shall comply with all pertinent provisions of the Kentucky Safety Standards of the Division of Occupational Safety, Department of Labor and Federal Occupational Safety and Health Construction Standards (OSHA), that are in effect at the time of this contract is entered into and during the period in which the contract is to be performed. Contractor shall also take or cause to be taken such additional measures as the Division of Occupational Safety may determine to be reasonable and necessary for the purpose.

The Contractor shall maintain an accurate account of and shall report to the Division of Occupational Safety in the manner and on the forms prescribed by the Division, exposure date and all accidents resulting in death, traumatic injury, occupational disease, and/or damage to property, materials, supplies, and equipment incident to work performed under this Contract.

The Division of Occupational Safety will notify the Contractor through the Owner of any non-compliance with the foregoing provisions and the action to be taken. The Contractor shall, after receipt of such notice, immediately correct conditions. Such notice when delivered to the Contractor or his representative at the site of work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until unsatisfactory or corrective action

has been taken. Failure or refusal to comply with the order will be grounds for stopping all payments due under the contract of the Contractor. No part of the time lost due to any such stop order shall be made the subject of claim for extension of the time or for excess cost or damages to the Contractor.

Compliance with the provisions of the foregoing sections by subcontractors will be the responsibility of the prime contractor.

Nothing in the aforesaid provisions shall prohibit the U.S. Department of Occupational Safety and Health from enforcing pertinent occupational safety and health standards authorized under Federal or State Occupational Safety and Health Law.

In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in Article 7 "Changes in Work".

## ARTICLE NO. 11 INSURANCE AND BONDS

## 11.1 CONTRACTOR'S LIABILITY INSURANCE

- 11.1.5 "The Owner will be responsible for providing Builders' Risk Insurance."
- 11.1.6 Contractor's General Liability Insurance policies shall include and cover Codell Construction Company as an additional insured for this project with respect to liability for bodily injury or property damage caused, in whole or in part, by your work or work performed for you, at the location designated in these documents. Codell Construction Company shall be an additional insured during the performance of this contract and at these premises additionally for products-completed operations. *Please be certain that we also receive all endorsements as required (ISO forms CG2010 07 04; CG 2037 07 04; IL011 07 09; CG2404 10 93; CA0444 03 10; and CG2001 04 13). Samples are available at the end of this section.* However, the addition or absence of ISO forms doesn't alter or delete this contractual liability. *All Additional Insured are to be provided with "FIRST DOLLAR" Coverage.*

As a successful bidder on this Project you will be required to sign a contract that requires your protection from financial cost resulting for your work and work done by your subcontractors. You are encouraged to read the full contract as your obligations are legally binding. It is important that all bidders understand that your insurance policies may not cover any or all claims for which your contract obligates your company. Compliance with certificates of insurance requirements does not remove or alter your full financial responsibility of any or all contract obligations, but rather is a minimum requirement. Any claim not covered by your insurance policies is a claim you will be required to pay directly or from your contract sums. This includes work performed by your subcontractors within the scope of your contract. You may have uninsured exposures!

The required endorsements as shown on the certificate examples are not only meant to protect the Owner, CM or GC per the contract but most importantly your company. As mentioned, whether you are insured or not, your financial responsibility to the owner, CM or GC is certain. Notwithstanding these minimum requirements you should discuss with your insurance agent how to provide you with the broadest protection available. Again if your insurance policies are not sufficient to pay your contractual obligations, you will still be obligated to pay by the contract you execute. This may include non-payment of retainage and any other amount due while you have financial contractual unmet obligations.

outstanding. Please review and read the provided sample contract prior to bidding on this Project.

- 11.3 PROPERTY INSURANCE
- 11.3.1 "The Owner<u>will</u> be responsible for providing Property Insurance related to this construction project."
- 11.4 PERFORMANCE BOND AND PAYMENT BOND

Add the following Subparagraphs:

- 11.4.1. "Contractor shall also furnish such other bonds as are required by the Supplementary Conditions. All Bonds shall be in the forms prescribed by the bidding documents or Supplementary Conditions and be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act. The Surety shall be acceptable to the Owner. All Bonds shall remain in effect at least until two years after the date of final payment, except as otherwise provided by law."
- 11.4.1."If the surety on any Bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in the state of the point of delivery or the surety ceases to meet the requirements stated in the above paragraph, Contractor shall within five days thereafter substitute another Bond and surety, both of which must be acceptable to Owner at no additional cost to Owner"

## ARTICLE NO. 13 MISCELLANEOUS PROVISIONS

## 13.1 GOVERNING LAW

Add the following subparagraph:

## 13.1.2 GENERAL EQUAL EMPLOYMENT POLICY

The Board of Education, an Equal Employment Opportunity and Affirmative Action Employer, has adopted the Model Procurement Regulations and they shall be deemed incorporated by reference in these Bidding and Contract Documents as though fully quoted herein. In the event of any conflict between these documents and the Model Procurement Regulations, the Regulations shall govern.

## 13.5 TESTS AND INSPECTIONS

13.5.1 In the last sentence, "The Owner shall bear costs...", change "Owner" to "Contractor".

Add the following Subparagraph:

13.5.7 "Testing of materials and systems shall be as specified in their particular sections of technical specifications."

Add the following Paragraphs:

## 13.8 NON-DISCRIMINATION

"During the performance on this Contract, the Contractor agrees as follows: The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, 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, creed, color, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, emotion, 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 setting forth the provisions of this non-discrimination clause.

The Contractor will, in all solicitations or advertisement for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

The Contractor will send each labor union or representative of workers with which he has a collective bargaining agreement or other contractor or understanding, a notice to be provided advising the said labor union or workers' representatives of the Contractor commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment. The Contractor will take such action with respect to any subcontract or purchase order as the administering agency sanctions for non-compliance."

- 13.9 AFFIDAVIT OR ASSURANCES
- 13.9.1 Prior to the execution of the Contract, the Owner will require of the Contractor a completed and notarized AFFIDAVIT OF ASSURANCES PURSUANT TO KRS 198b.060(10).

A copy of the affidavit for DOH-BCD-or, dated 7/90, is included as a part of these Supplemental Conditions.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

## 14.2 TERMINATION BY THE OWNER FOR CAUSE

- (1) Subparagraph 14.2.2
  - a. Delete the word "seven" and replace with "three".

CASE NO.\_\_\_\_\_ PROJECT NAME:\_\_\_\_\_ CITY/COUNTY:\_\_\_\_\_

## \*AFFIDAVIT OF ASSURANCES PURSUANT TO KRS 198B.060(10)

Comes the Applicant,\_\_\_\_\_

\_\_\_\_\_, and states (Print Name)

Pursuant to KRS 198B.060(10), that all contractors and subcontractors employed or that will be employed on any activity under the above referenced project shall be in compliance with the Commonwealth of Kentucky requirements for Worker's Compensation Insurance (according to KRS Chapter 341).

THIS, the \_\_\_\_\_\_ day of \_\_\_\_\_\_, 200

CONTRACTOR, OWNER, OR OWNER'S AGENT

SUBSCRIBED AND SWORN to before me by \_\_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_\_, 200 \_\_\_\_\_\_\_, 200 \_\_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200 \_\_\_\_\_\_, 200

NOTARY PUBLIC, STATE AT LARGE

MY COMMISSION EXPIRES:\_\_\_\_\_

\*()The Affidavit of Assurances is not required because the local building code official was, or will be presented the assurances upon issuance of the local building permit.

ACORD

# CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

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## ADDITIONAL INSURED - OWNERS, LESSEES OR CONTRACTORS - SCHEDULED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

#### COMMERCIAL GENERAL LIABILITY COVERAGE PART

#### SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location(s) Of Covered Operations
To read as required in contract	To be completed for each project location
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- A. Section II Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:
  - 1. Your acts or omissions; or
  - The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above. B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

- All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
- 2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

# ADDITIONAL INSURED - OWNERS, LESSEES OR CONTRACTORS - COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

## COMMERCIAL GENERAL LIABILITY COVERAGE PART

## SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location And Description Of Completed Operation
To read as required in the contract	To be completed for each project location
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formation required to complete this Schedule if not	shown above will be shown in the Declarations

Section II - Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

## AMENDED NOTICE OF CANCELLATION PROVIDED BY US

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM BUSINESS AUTO PHYSICAL DAMAGE COVERAGE FORM BUSINESSOWNERS COVERAGE FORM COMMERCIAL CRIME COVERAGE FORM COMMERCIAL GENERAL LIABILITY COVERAGE PART COMMERCIAL INLAND MARINE COVERAGE PART COMMERCIAL LIABILITY UMBRELLA COVERAGE FORM COMMERCIAL OUTPUT POLICY COMMERCIAL PROPERTY COVERAGE PART FARM COVERAGE PART FARM COVERAGE PART FARM UMBRELLA COVERAGE FORM GARAGE COVERAGE FORM LIQUOR LIABILITY COVERAGE PART PRODUCT WITHDRAWAL COVERAGE PART PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

#### SCHEDULE

A. Number of Days' Notice: 30

B. Person(s) or Organization Name and Address:

To be completed per the contract with correct address of party to be notified

(If no entry appears above, information required to complete this Schedule will be shown in the Declarations as applicable to the endorsement.)

For any statutorily permitted reason other than nonpayment of premium, the number of days required for notice of cancellation to the first Named Insured, as provided in **Paragraph 2**. of either the Cancellation Common Policy Condition or as amended by an applicable state cancellation endorsement, is increased to the number of days shown in item **A**. in the Schedule above.

When a person or organization is listed in item **B**, in the Schedule above, the num ber of days notice in item **A**, also applies to the person(s) or organization listed in the schedule.

## WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US

This endorsement modifies insurance provided under the following: COMMERCIAL GENERAL LIABILITY COVERAGE PART

## SCHEDULE

Name of Person or Organization:

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

The TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US Condition (Section IV ~ COMMERCIAL GENERAL LIABILITY CONDITIONS) is amended by the addition of the following:

We waive any right of recovery we may have against the person or organization shown in the Schedule above because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a contract with that person or organization and included in the "products-completed operations hazard". This waiver applies only to the person or organization shown in the Schedule above.

# WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US (WAIVER OF SUBROGATION)

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM BUSINESS AUTO PHYSICAL DAMAGE COVERAGE FORM GARAGE COVERAGE FORM MOTOR CARRIER COVERAGE FORM TRUCKERS COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Forn apply unless modified by the endorsement.

This endorsement changes the policy effective on the inception date of the lice unless another date is indicated below.

CHEDUL

Named Insured:

Endorsement Effective Date:

Name(s) Of Person(s) Or Organization(s):

Information required to complete this Scherole, if not shown above, will be shown in the Declarations.

The Transfer Of Rights Of Receivery Against Others To Us Condition of as not apply to the person(s) or organization(s) a win a the occhedule, but only to the extent that, ubro ation waived prior to the "accident" or the "los" under a contract with that person or organization.

# PRIMARY AND NONCONTRIBUTORY – OTHER INSURANCE CONDITION

This endorsement modifies insurance provided under the following:

## COMMERCIAL GENERAL LIABILITY COVERAGE PART PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

The following is added to the **Other Insurance** Condition and supersedes any provision to the contrary:

#### **Primary And Noncontributory Insurance**

This insurance is primary to and will not seek contribution from any other insurance available to an additional insured under your policy provided that:

- (1) The additional insured is a Named Insured under such other insurance; and
- (2) You have agreed in writing in a contract or agreement that this insurance would be primary and would not seek contribution from any other insurance available to the additional insured.

# Kentucky Department of Education Version of MAIA Document A132™ – 2009

# Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition

day of

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

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

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

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

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

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



This version of AIA Document A132–2009 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A132 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A132–2009 showing additions and deletions by the Kentucky Department of Education is available for review on the Kentucky Department of Education Web site.

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

This document is intended to be used in conjunction with KDE versions of AIA Documents A232<sup>™</sup>–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132<sup>™</sup>–2009, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132<sup>™</sup>–2009, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

AIA Document A232™–2009 — KDE Version is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

1

The Owner and Contractor agree as follows.

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#### TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS

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- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 10 INSURANCE AND BONDS

#### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Owner direct Purchase Orders, Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

#### ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

## ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner. (Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

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

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

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§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than

) days from the date of commencement, or as follows:

(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work. Either list requirements for earlier Substantial Completion here or refer to an exhibit attached to this Agreement.)

#### Portion of the Work

## **Substantial Completion Date**

(\$

),



, subject to adjustments of this Contract Time as provided in the Contract Documents. (Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

§ 3.4 Liquidated Damages. As actual damages for delay in completion of Work are impossible to determine, the Contractor and his Surety shall be liable for and shall pay to the Owner the sum of

not as a penalty, but as fixed, agreed and liquidated damages for each calendar day of delay until the Contract Work is substantially completed as defined in the General Conditions of the Contract for Construction. The Owner shall have the right to deduct liquidated damages from money in hand otherwise due, or to become due, to the Contractor, or to sue and recover compensation for damages for failure to substantially complete the Work within the time stipulated herein. Said liquidated damages shall cease to accrue from the date of Substantial Completion.

#### ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be a Stipulated Sum in accordance with Section 4.2 below, less the Owner's direct Purchase Orders, if any, for Project materials or equipment.

Init.

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#### § 4.2 Stipulated Sum

§ 4.2.1 The Stipulated Sum shall be

(\$), subject to additions and deletions as provided in the Contract Documents. (List the base bid amount, sum of accepted alternates, total construction cost (the sum of base bid amount plus sum of accepted alternates), sum of Owner's direct Purchase Orders. The Contract Sum shall equal the sum of Total Construction Cost, less Owner direct Purchase Orders. Either list this information here or refer to an exhibit attached to this Agreement.)

	Amount	
Base Bid	\$	
Sum of Accepted Alternates	\$	
Total Construction Cost (the sum of base bid amount plus sum of accepted alternates)	S	X.I
Sum of Owner's direct Purchase Orders	\$	
Contract Sum (total construction cost less Owner direct Purchase Orders)	\$	

§ 4.2.2 The Stipulated Sum is based on the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires. Either list alternates here or refer to an exhibit attached to this Agreement.)

Item Description	Amount
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And Martine	
all all all the second	
13	
and the second sec	
Total of Alternates	
	Item Description

#### § 4.2.3 Unit prices, if any:

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(Identify and state the unit price, and state the quantity limitations, if any, to which the unit price will be applicable. Either list unit prices here or refer to an exhibit attached to this Agreement.)

Price per Unit (\$0.00) Units and Limitations § 4.2.4 Allowances included in the Stipulated Sum, if any: (Identify allowance and state exclusions, if any, from the allowance price. Either list allowances here or refer to an exhibit attached to this Agreement.)

Price

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Item

item

## **ARTICLE 5 PAYMENTS**

#### § 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Construction Manager by the Contractor, and upon certification of the Project Application and Project Certificate for Payment or Application for Payment and Certificate for Payment by the Construction Manager and Architect and issuance by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Construction Manager not later than the day of a month, the Owner shall make payment of the certified amount in the Application for

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Payment to the Contractor not later than the day of the month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment shall be made by the Owner not later than () days after the Construction Manager

receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

## § 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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

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

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of

percent (%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.9 of the General Conditions;

- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent ( %);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of the General Conditions.

§ 5.1.4.4 The progress payment amount determined in accordance with Section 5.1.4.3 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to percent ( %) of the Contract Sum, less such amounts as the Construction Manager recommends and the Architect determines for incomplete Work and unsettled claims; and
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of the General Conditions.

§ 5.1.4.5 When Owner direct Purchase Orders are used, retainage that would otherwise be held on materials and equipment shall transfer to the Contractor, and the material suppliers will be paid the full amount of their invoices. The Owner shall retain ten percent (10%) from each Application for Payment, and an amount equal to ten percent (10%) of approved Purchase Order payments, up to fifty percent (50%) completion of the Work, then provided the Work is on schedule and satisfactory, and upon written request of the Contractor together with consent of surety and the recommendation of the Architect, the Owner shall approve a reduction in Retainage to five percent (5%) of the current Contract Sum plus Purchase Orders. No part of the five percent (5%) retainage shall be paid until after Substantial Completion of the Work, as defined in the General Conditions of the Contract for Construction. After Substantial Completion, if reasons for reduction in retainage may be approved by the Owner when deemed reasonable. The minimum lump sum retainage shall be twice the estimated cost to correct deficient or incomplete work.

#### § 5.2 Final Payment

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

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- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2 of AIA Document A232–2009 — KDE Version, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 (Not Used)
- .3 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment: and
- .4 Neither the final payment nor any part of the remaining retained percentage of all payments shall become due until the Contractor delivers to the Owner an affidavit that all payrolls, bills for materials, supplies and equipment, and other indebtedness connected with the work have been paid or otherwise satisfied and Consent of Surety to make final payments is received.

### **ARTICLE 6 DISPUTE RESOLUTION**

### § 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A232–2009 — KDE Version, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker. (If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

### § 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A232–2009 — KDE Version, the method of binding dispute resolution shall be as follows:

(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

- Arbitration pursuant to Section 15.4 of AIA Document A232-2009 KDE Version.
- Litigation in a court of competent jurisdiction where the Project is located.
- □ Other: (Specify)

### ARTICLE 7 TERMINATION OR SUSPENSION

### § 7.1 Where the Contract Sum is a Stipulated Sum

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2009 — KDE Version.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2009 — KDE Version; in such case, the Contract Sum and Contract Time shall be increased as provided in Section 14.3.2 of AIA Document A232–2009 — KDE Version.

### ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2009 — KDE Version or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located. (Insert rate of interest agreed upon, if any.)

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

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

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

### ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

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

§ 9.1.1 The Agreement is this executed AIA Document A132–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition — KDE Version.

§ 9.1.2 The General Conditions are, AIA Document A232–2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition ---- KDE Version.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

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(Either list Supplementary and other Conditions of the Contract here or refer to an exhibit attached to this Agreement.)



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(Either list the Addenda here or refer to an exhibit attached to this Agreement.)

Date

Number

Pages

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

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents are:

- .1
- .2
- .3
- 4 Other documents, if any, listed below:

(List here any additional documents which are intended to form part of the Contract Documents. AIA Document A232–2009 — KDE Version provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

- A. AIA Document A701<sup>TM</sup>-1997, Instructions to Bidders KDE Version
- B. Contractor's Form of Proposal
- C. KDE Purchase Order Summary Form

### ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A232-2009 — KDE Version.

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(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A232–2009 — KDE Version. Either list insurance and bond information here or refer to an exhibit attached to this Agreement.)

Type of Insurance or Bond

Limit of Liability or Bond Amount (\$0.00)

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

**OWNER** (Signature)

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**CONTRACTOR** (Signature)

(Printed name and title)

(Printed name and title)

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### SECTION 00450

### Kentucky Department of Education Version of MAIA Document A312™ – 2010

### **Performance Bond**

### CONTRACTOR:

(Name, legal status and address)

SURETY: (Name, legal status and principal place of business)

**OWNER:** (*Name, legal status and address*)

CONSTRUCTION CONTRACT Date:

Amount:

Description: (*Name and location*)

### BOND

Date: (Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond:

□ See Section 16

CONTRACTOR AS PRINCIPALSCompany:(Corporate Seal)Company:Corporate Seal)

SURETY Seal) Company:

(Corporate Seal)

Signature: \_\_\_\_\_ Name and Title: Signature: Name and Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY – Name, address and telephone) AGENT or BROKER: OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)



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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

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AlA Document A312<sup>TM</sup>-2010 and Kentucky Department of Education Version of AlA Document A312<sup>TM</sup>-2010. The American Institute of Architects. This document was created on under license number , and is not for resale. This document is licensed by The American Institute of Architects for one-time use only, and may not be reproduced prior to its completion. §1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

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§8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

### § 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

§ 16.1 Surety Company shall be licensed to conduct business in the Commonwealth of Kentucky.

§ 16.2 Insurance Agency and Agents issuing bond shall be registered and licensed to conduct business in the Commonwealth of Kentucky with the appropriate Power of Attorney included.

§ 16.3 Bond shall comply with all statutory requirements of the Commonwealth of Kentucky including the Kentucky Unemployment Insurance Law.

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**§ 16.4** No suit, action or proceeding by reason or any default whatever shall be brought on this bond after two (2) years from the date on which final payment of the contract fall due and provided further that if any alterations or additions which may be made under the contract or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal shall not, in any way, release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns for their liability hereunder. Notice to the Surety of any such alterations, extensions, or forbearance being expressly waived.

This obligation shall remain in force and effect until the performance of all covenants, terms and conditions herein stipulated and after such performance, it shall become null and void.

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)CONTRACTOR AS PRINCIPALSURETYCompany:(Corporate Seal)Company:Company:

Signature:	Signature:	
Name and Title:	Name and Title:	
Address	Address	

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### Kentucky Department of Education Version of ATA Document A312™ – 2010

### **Payment Bond**

### CONTRACTOR:

(Name, legal status and address)

SURETY: (Name, legal status and principal place of business)

### **OWNER:**

(Name, legal status and address)

### CONSTRUCTION CONTRACT Date:

Amount:

Description: (Name and location)

### BOND

Date: (Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: □ None □ See Section 18

CONTRACTOR AS PRINCIPAL (Corporate Seal) Company:

SURETY Company:

(Corporate Seal)



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

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312-2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

Signature: Name

and Title:

Signature: Name and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY - Name, address and telephone) **OWNER'S REPRESENTATIVE:** AGENT or BROKER:

(Architect, Engineer or other party:)

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**§ 1** The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any

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Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

**§ 12** No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

### § 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

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§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

§ 18.1 Surety Company shall be licensed to conduct business in the Commonwealth of Kentucky.

§ 18.2 Insurance Agency and Agents issuing bond shall be registered and licensed to conduct business in the Commonwealth of Kentucky with the appropriate Power of Attorney included.

§ 18.3 Bond shall comply with all statutory requirements of the Commonwealth of Kentucky including the Kentucky Unemployment Insurance Law.

§ 18.4 No suit, action or proceeding by reason or any default whatever shall be brought on this bond after two (2) years from the date on which final payment of the contract fall due and provided further that if any alterations or additions which may be made under the contract or in the work to be done under it, or the giving by the Owner of any extension of time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal shall not, in any way, release the Principal and Surety, or either of them, their heirs, executors, administrators, successors, or assigns for their liability hereunder. Notice to the Surety of any such alterations, extensions, or forbearance being expressly waived.

This obligation shall remain in force and effect until the performance of all covenants, terms and conditions herein stipulated and after such performance, it shall become null and void.

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)CONTRACTOR AS PRINCIPALSURETYCompany:(Corporate Seal)Company:Company:

Signature: Name and Title: Address Signature: Name and Title: Address

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Document G732 <sup>™</sup> – 2009
<b>i</b>

### APPLICATION AND CERTIFICATE FOR PAYMENT AIA DOCUMENT G732/CMa

TO OWNER:

CONSTRUCTION PAGES MANAGER Distribution to: OWNER 2 PAGE ONE OF PROJECT NO: PERIOD TO: APPLICATION PROJECT:

CONSTRUCTION MANAGER-ADVISER EDITION

FROM CONTRACTOR:

CONTRACT FOR:

# CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

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<ol> <li>MODIFIED CONTRACT SUM</li> <li>Net change by Change Orders</li> <li>CONTRACT SUM TO DATE (Line 1 ± 2)</li> <li>TOTAL COMPLETED &amp; STORED TO DATE (Column G on G703)</li> </ol>	b. Activition. a. 0 % of Completed Work \$ (Column D+E on G703) b. (Column F on G703) b. (Column F on G703) Column F on G703)	Total in Column I of G703)	<ol> <li>TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5 10tal)</li> <li>LESS PREVIOUS CERTIFICATES FOR</li> </ol>	PAYMENT (Line 6 from prior Certificate) 8. CURRENT PAYMENT DUE	<ol> <li>BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)</li> </ol>	CHANGE ORDER SUMMARY	Total approved in previous months by Owner	Total approved this month including Construction Change Directives	TOTALS	NET CHANGES by Change Order

completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due. information and belief the Work covered by this Application for Payment has been The undersigned Contractor certifies that to the best of the Contractor's knowledge.

CONTRACTOR

CONTRACT DATE:

ARCHITECT

CONTRACTOR:

Date: Subscribed and sworn to before My Commission expires: day of Votary Public: County of: State of: me this

## CERTIFICATE FOR PAYMEN

In accordance with the Contract Documents, based on evaluations of the Work and

to the Owner that to the best of their knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED. the data comprising this application, the Construction manager and Architect certify

(Attach explanation if amount certified differs from the amount applied for. Initial all figures on this Application and on the Continuation Sheet that changed to conform to the 0,00 5 CONSTRUCTION MANAGER: AMOUNT CERTFIED

By: ARCHITECT: (NOTE: If Multiple Prime Contractros are responsible for performing portions of Date the Project, the Architect's Certification is not required.

Date:

BA:

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Users may obtain validation of this document by requesting of the license a completed AIA Document D401 - Certification of Document's Authenticity AIA DOCUMENT G702/CMB - APPLICATION AND CERTIFICATION FOR PAYMENT - CONSTRUCTION MANAGER-ADVISER EDITION - 1982 EDITION - AIA® - © 1982 THE AMERICAN INSTITUTE OF ARCHITECTS, 1745 NEW YORK AVE., N.W., WASHINGTON, DC 20005-222

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### SECTION 00520 PARTIAL WAIVER AND RELEASE OF CLAIMS FOR PAYMENT

STATE OF \_\_\_\_\_

(use for all tiers)

NHEREAS, the undersigned ("Undersigned") has been employed b	У	121	("OWNER","C	ONTRACTOR", or	"CONSTRUCTION
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ist	he owner ("OWNER") and on wi	nich	Incolor J of W		
s also a ("CONTRACTOR" or "CONSTRUCTION MANAGER").					
The Undersigned, for and in consideration of and in consideration of such sum and other good and valuable considera Contractor, the Contractor's Surety, the Construction Manager, the past and present officers, directors, heirs, and administrators, from any a statutes of the municipality, state or federal government relating to payr addition all liep or claim of or right to liep under municipal state or federal	ations, UPON RECIEPT, do(es) fo <b>Construction Manager's surety</b> and all suits, debts, demands, tort ient bonds, the Miller Act, or other local laws or statutes, relation to a	(\$	) C administrators, he s, parents, subsidia on and claims for p ompt payment stat	Pollars, reby waive and rele aries, related entitie ayment, including cl utes, or bonds relat	ase <b>the Owner, the</b> s, affiliates, member aims under the laws ing to the Project, a olect and the
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itle of Person Signing: IOTE: *Extras include but are not limited to changes, both oral and writ CONSTRUCTION MANAGER. All waivers and releases must be for the of officer signing wavier and release should be set forth: if waiver and re	Notary S ten, to the contract, and Claims a e full amount paid. If waiver and r lease is for a partnership, the par	ignature and Seal: s defined in the Undersign elease is for a corporation tnership name should be u	ed's contract with t , corporate name s ised, partner shoul	he OWNER, CONT hould be used, corp d sign and designat	RACTOR, or orate seal affixed ar e himself as partner
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COUNTY OF O WHOM IT MAY CONCERN:					
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NAMES	TYPE /SCOPE WORK	CONTRACT PRICE	PAID	PAYMENT	BALANCE DUE
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hat there are no other contracts for said work outstanding, and that the connection with said work other than above stated	ere is nothing due or to become d	ue to any person for mater	ial, labor, or other	work of any kind do	ne or to be done upo
Date: Name of	Company		(Und	ersigned)	

Signature:		Printed Name:		Title:
Subscribed and sworn before me this	day of	, 20	Notary Signature and Seal:	





### Contractor's Affidavit of Payment of Debts and Claims

OWNER	Х
ARCHITECT	Х
CONTRACTOR	Х
SURETY	Х
OTHER	

PROJECT: (Name and address)

ARCHITECT'S PROJECT NUMBER: BID PACKAGE: CONTRACT FOR: CONTRACT DATED:

TO OWNER: (Name and address) BRECKINRIDGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD HARDINSBURG, KY 40143 TO CM: Codell Construction Company PO Box 17 Winchester KY 40392-0017

### STATE OF:

### COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor and the Owner for damages arising in any manner in connection with the performance of the Contract referenced above. **EXCEPTIONS:** 

### SUPPORTING DOCUMENTS ATTACHED HERETO:

 Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment Yes No

The following supporting documents should be attached hereto if required by the Owner:

- 1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- 2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- 3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

**CONTRACTOR:** (Name and address)

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

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SECTION 00600 AIA Document G707<sup>™</sup> – 1994

### **Consent Of Surety to Final Payment**

PROJECT: (Name and address)

**ARCHITECT'S PROJECT NUMBER:** CONSTRUCTION MANAGER PROJECT **CONTRACT FOR:** CONTRACT DATED:

TO OWNER: (Name and address) BRECKINRIDGE COUNTY BOARD OF EDUCATION **86 AIRPORT ROAD** HARDINSBURG, KY 40143

In accordance with the provisions of the contract between the Owner and the Contractor as indicated above, the (Insert name and address of Surety)

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on bond of (Insert name and address of Contractor)

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hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to (Insert name and address of Owner) BRECKINRIDGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD, HARDINSBURG, KY 40143

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand in this date: (Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

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User Notes:

(2843275340)

OWNER

OTHER

ARCHITECT

CONTRACTOR SURETY Х

Х Х

Х

, SURETY,

OWNER,

Attest:

(Seal):

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### CONTRACTOR,

SECTION 00620

**AIA** Document G706A<sup>\*\*</sup> – 1994

### **Contractor's Affidavit of Release of Liens**

OWNER X ARCHITECT X CONTRACTOR X SURETY X OTHER

**PROJECT:** (Name and address)

ARCHITECT'S PROJECT NUMBER: CONTRACT FOR: CONTRACT DATED:

TO OWNER: (Name and address) BRECKINRIDGE COUNTY BOARD OF EDUCATION 86 AIRPORT ROAD HARDINSBURG, KY 40143

### STATE OF:

COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

**EXCEPTIONS:** 

### SUPPORTING DOCUMENTS ATTACHED HERETO:

- 1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

**CONTRACTOR:** (Name and address)

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public: My Commission Expires:

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User Notes:

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### SECTION 00650

### Mechanic's Lien and Tax Release Certification of Payment of Debts and Claims

State of \_\_\_\_\_)

County of \_\_\_\_\_)

WHEREAS, under date of the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_, BRECKINRIDGE COUNTY BOARD OF EDUCATION, as Owner, did enter into an agreement with as Contractor, for construction of the BRECKINRIDGE COUNTY AREA TECHNOLOGY CENTER at 1915 E. HIGHWAY 60, HARNED, KY 40144 - Bid Package \_\_\_\_.

AND, WHEREAS, Contractor has completed all work required by the above-referenced agreement; Now this statement under oath is given in compliance with the provisions of any applicable Mechanic's Lien Law and to enable said Contractor to receive his final payment from the Owner. The Contractor further says that all lienors contracting directly with, or directly employed by him, on or in connection with the agreement have been paid in full. The Contractor also certifies that any and all liens, assessments, charges and taxes with respect to the above-described agreement, including, but not limited to, sales or use taxes, and penalties and interest with respect thereto, have been paid.

We further certify that we have complied with the provisions and requirements of all federal and state labor laws and wage requirements as set forth in the agreement and that all bills, wages, rentals, taxes and accounts of every nature relating to said project have been paid in full.

Furthermore, Contractor does Hereby Indemnify and Hold Harmless **BRECKINRIDGE COUNTY BOARD OF EDUCATION** from any and all claims, actions, or demands which may exist or arise by any reason whatsoever from the nonpayment or incomplete payment, whether or not intentional or with knowledge by Contractor or lienors described above or any of the above-stated taxes.

	Contractor	
	By:	
SWORN TO AND SUBSCRIBED	BEFORE ME, this day of	

Notary Public

### SECTION 01000 SITE CONDITIONS

- 1. The site is located as follows: 1915 E. HIGHWAY 60, HARNED, KY 40144.
- 2. All contractors shall examine the site of the construction for top configurations, foliage, ground structures, existing structures and all other pertinent conditions, and be familiar with work to be performed as hereinafter specified and as outlined on the Drawings.
- 3. All contractors shall exercise extreme caution while performing work in the area of existing underground work. Locate all underground utilities by careful hand excavation and provide all necessary and proper protection from damage.
- 4. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavating, consult Architect, Engineer or CM immediately for directions as to procedure. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner, and at no cost to the owner.
- 5. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Architect/Engineer or CM, and then only after temporary utility services have been provided.
- 6. Each Contractor shall perform his layout and grade work. CM reserves the right to check Contractors work at his discretion. Contractor will, upon request, assist the CM with verification of Contractor's work.
- 7. Each Contractor shall compare all levels given on drawings with actual levels and shall call attention to discrepancies if any occur.
- 8. Each Contractor shall verify and document with the Construction Manager all lines and levels and be responsible for the proper location of all his work.
- 9. The Contractor shall at all times enforce strict discipline and good order among the Contractor's employees. Any person conducting themselves in an inappropriate manner will be removed from the jobsite at the request of the Owner, Architect, Construction Manager, or their employer. There will be no loitering by any employees on the Owner's property before or after the normal working hours for this project. Special effort shall be made by Contractor to prevent employees from entering unauthorized areas.

Section 01000 Site Conditions Page 2

- 10. For the duration of the Contract, each Contractor shall maintain all excavations, embankments, haul roads, access roads, parking lots, borrow areas, and all other work areas free from dust or mud, as determined by the Construction Manager. Industrial-accepted method of dust control suitable for the area involved, such as sprinkling, chemical treatment, or similar methods, will be permitted. All parking areas and roadways will be cleaned as required by the Construction Manager. No separate payment will be made for dust or mud control.
- 11. Contractor shall not permit fires within or adjacent to the limits of the project sites and shall be liable for all damage from any fire due directly, or indirectly, to its own activities or to those activities of its employees or of its subcontractors or any of their employees. Contractor shall provide portable fire extinguisher compatible with the hazard of each work area and shall instruct its personnel in their location and use. Wherever welding and burning are conducted, inflammable materials shall be protected and a fire watch shall be provided by Contractor to be present during the burning and welding operation to ensure that protective operation. The fire watch shall have extinguisher equipment readily available and know-how for proper use.
- 12. Any existing roads, walks, grassed areas or facilities damaged or destroyed shall be repaired or replaced to the satisfaction of the Architect, Construction Manager, and Owner. The expense will be borne completely by the Contractor or Material Supplier responsible.
- 13. The Contractor will be responsible for keeping all roadways clean.
- 14. The use of drugs and alcohol is prohibited on the project site.
- 15. Firearms are prohibited on the project site.

- 1.1 The Construction Manager is to establish and monitor the overall project construction schedule based upon milestone dates tied to the Owner's Notice to Proceed. Each Contractor shall cooperate with the Construction Manager to establish realistic delivery dates, manpower requirements and time frames required for the proper scheduling of the job. A copy of the Project Schedule shall be displayed at the job site at all times. The Construction Manager shall update this schedule periodically if required and establish new milestone dates. It shall be each Contractor's responsibility to keep himself advised of the job progress and the effects upon his work.
- 1.2 It shall be mutually understood and agreed by the Contractor and other parties to the Contract that time is of the essence. In event that the Contractor fails to substantially complete work to be performed under this Contract by and at applicable completion time bid in the proposal, including any extension of time granted under General Conditions, the Contractor shall pay to the Owner \$1,000.00 (One Thousand Dollars and No Cents) per calendar day as liquidated damages for the duration of the delay period. This amount applies to each bid division and will not be proportioned if more than one Contractor is proven at fault in causing the delay. In no event shall any delays or extensions of time be construed as cause or justification for payment of extra compensation to the Contractor.
- 1.3 The following Project Construction Schedule is based upon milestone dates established by specific time periods, in calendar days, from the Notice to Proceed. Adjustment of the date of Notice to Proceed or other adjustments not the fault of or not controlled by the Contractor shall cause the Project Construction Schedule milestone dates to be adjusted accordingly.
- 1.4 Project Construction Schedule: Final Completion is (480) Calendar Days from Notice to Proceed. See Addendum for Actual Construction Schedule.
- 1.5 Upon acknowledgment of the Notice to Proceed and continuing throughout the Contract, the Contractor shall record on the daily report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically for the first to the last day of each month, and be recorded as full days. The Construction Manager will convert any qualifying delays to calendar days, giving full consideration

### SECTION 01010 CONSTRUCTION SCHEDULE

for equivalent fair weather work days, and issue a letter in accordance with the appropriate Contract conditions (a day for a day). Contractors are not entitled to seek compensation for weather delay days and waive any right to claim such compensation.

- 1.6 The "float" contained within the schedule belongs to the schedule which is maintained by the CM. Therefore, the schedule may not be affected by a time extension due to the available float within the schedule.
- 1.7 The original baseline schedule is issued to all contractors prior to bid with the working durations listed for a contractor to complete a certain task. The contractor must consider these durations in their bid as these durations will not change after bids are placed. Each contractor must bid the project with manpower requirements to meet the durations listed. NO EXCEPTIONS.
- 1.8 The calendar timeline shown on the schedule is the most logical sequencing for each task to occur. These dates may or may not change depending on the start of the project or possible delays of a preceding task(s). The contractor must be flexible with the calendar as delays can occur that are unknown at the issuance of this schedule. Codell Construction Company will issue a tracking schedule at each monthly progress meeting with a current working schedule to notify each contractor of possible delays, change orders and/or early starts of all work tasks.

### SECTION 01030 - ALTERNATES AND ALLOWANCES

An alternate is an amount proposed by Bidders and stated on the Form of Proposal for certain items that may be added or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in the Contract Documents.

**<u>Coordination</u>**: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted alternate is complete and fully integrated into the Project.

**Notification**: Immediately following Contract award, prepare and distribute to each party involved, notification of the status of each alternate. Indicate whether alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates.

**Schedule**: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each alternate.

Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

### **SCHEDULE OF ALTERNATES:**

Alternate #1	GYM SEPERATION CURTAIN
Alternate #2	EXCLUDE GYM BULKHEADS IN CAFETERIA
Alternate #3	CANOPY ALTERATIONS ALONG DROP OFF LANE
Alternate #4	EXCLUDE ALVES STREET PARKING LOT
Alternate #5	EXCLUDE BASKETBALL AND FOURSQUARE COURTS

### SECTION 01100 PROJECT COORDINATION DESCRIPTION

This project is being expedited through the method of Construction Management. In effect, the Owner is his own General Contractor and provides coordination and on-site supervision through the Construction Manager, acting as the Owner's agent.

### DUTIES OF CONSTRUCTION MANAGER

- 1. Coordinate and schedule work of the various contractors.
- 2. Establish on-site lines of authority and communication, schedule and conduct project meetings among the following:
  - a. Owner's Representative
  - b. Architect
  - c. Engineers
  - d. Consultants
  - e. Contractors
  - f. Material Suppliers
- 3. Construction Schedules:
  - a. Coordinate schedules of the several contractors.
  - b. Monitor schedules as work progresses.
    - I. Identify potential variances between scheduled and probable completion.
    - ii. Recommend adjustments in schedule to meet required completion date.
    - iii. Provide summary reports on each monitoring.
    - iv. Document all changes in schedule.
  - c. Observe work to monitor compliance with schedule.
    - I. Verify that labor, equipment and product deliveries are adequate to maintain schedule.
    - ii. Report non-compliance to Owner with recommendation for remedy.
- 4. Temporary Facilities:
  - a. Allocate space for temporary structures furnished by each contractor.
  - b. Monitor use of temporary utilities.
  - c. Verify that adequate services are provided to comply with requirements for work and climatic conditions.
  - d. Verify proper maintenance and operation of temporary and permanent facilities.
  - e. Administer use of Owner's facilities.
  - f. Administer traffic and parking controls, coordinate and delegate areas for onsite storage of materials.

### SECTION 01100 PROJECT COORDINATION

- 5. Changes:
  - a. Recommend necessary or desirable changes to Architect.
  - b. Review Contractors' request for changes and for substitutions; submit recommendations to Architect.
  - c. Assist Architect in negotiating change orders.
  - d. Assist in the implementation of change orders.
- 6. Interpretations of Contract Documents:
  - a. Consult with Architect to obtain interpretations.
  - b. Assist in resolution of questions which may arise.
  - c. Transmit written interpretations to concerned parties.
- 7. Administer processing of:
  - a. Payment requests.
  - b. Shop drawings, product data and samples.
  - c. Field drawings.
  - d. Coordination drawings.
  - e. Change orders.
- 8. Verify that specified cleaning is done.
  - a. During progress of work.
  - b. At completion of each contract.
- 9. Substantial completion:
  - a. Upon determination of substantial completion of work, or portion thereof, prepare for Architect a list of incomplete or unsatisfactory items.
- 10. Final Completion:
  - a. Upon determination that work is finally completed:
    - I. Submit written notice to Architect and Owner's representative that work is ready for final inspection.
    - ii. Secure and transmit to Architect required closeout submittals.
  - b. Turn over to Architect warranties, operations and maintenance data for review.
  - c. Turn over to Owner spare parts and maintenance materials.
- 11. The Construction Manager reserves the right to monitor payment and delivery activities direct with Contractor's suppliers. Each Contractor will provide, upon request by CM, a complete list of suppliers with purchase order numbers, addresses, telephone numbers, and contact person under respective bid divisions.

### SECTION 01100 PROJECT COORDINATION DUTIES OF EACH CONTRACTOR

- 1. Coordinate work of employees and subcontractors under the Contract.
- 2. Provide adequate information (time frames and manpower requirements) and delivery dates for the development of a Project Schedule by the CM.
- 3. Conduct work and expedite materials and equipment to assure compliance with schedules.
- 4. Transmit written instructions to concerned suppliers and subcontractors.
- 5. Under the administration of the Construction Manager, coordinate work with that of other contractors.
- 6. Cooperate with CM and Architect/Engineer.
- 7. Forward all communications to the Owner and Architect through the CM.
- 8. Attend Project Meetings as required, or as determined by the Construction Manager.
- 9. The normal work schedule will be five (5) eight (8) hour days, Monday through Friday of each week. Any deviation from this schedule will be subject to the approval of the Construction Manager. Contractors may be required to work additional hours to maintain construction schedule, at no additional cost to Owner.
- 10. Provide adequate manpower, material and equipment to keep the jobsite and work areas free from debris, dust and mud. Each Contractor shall be responsible for the removal from the site of debris resulting from the processing of their work.

### CONSTRUCTION AND SAFETY DEVICES

- 1. a. Provide safety controls for protection of life and health of employees. Utilize precautionary methods for prevention of damage of property, materials, supplies and equipment, and for avoidance of work interruptions in performance of this Contract.
  - b. In order to provide such safety controls aforesaid, Contractor shall comply with all pertinent provisions of Kentucky Safety Standards of Division of Occupational Safety, Department of Labor, and Federal Occupational Safety and Health Construction Standards, that are in effect at the time this Contract is entered into and during the period in which the Contract is to be performed.
  - c. Compliance with provisions of foregoing sections by subcontractors shall be the responsibility of the prime contractor.

### SECTION 01100 PROJECT COORDINATION TRANSPORTATION

- 1. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.
- 2. More detailed requirements for transportation and handling are specified under technical sections.

### STORAGE AND PROTECTION

1. Store and protect materials delivered at site from damage. Do not use damaged material on work. Protect existing roof warranty and from damage.

### **IDENTIFYING MARKINGS**

1. Do not fix nameplates and other identifying markings on exposed surfaces of manufactured items installed in finished spaces.

### MEASUREMENTS

- 1. All Contractors furnished materials and equipment for this contract shall obtain exact dimensions at site.
- 2. Scale and figure dimensions on Drawings indicate correct size under ideal conditions and shall not, under any circumstances, be so construed as to relieve Contractor from responsibility of taking measurements at site and furnishing materials and equipment of correct size.

### **COOPERATION AND DISPUTES**

- 1. The timely completion of this project is dependent largely upon the close and active cooperation and coordination of all those involved. It is therefore expressly understood and agreed that each Contractor shall lay out and install his work at such time or times, and in such a manner, as not to delay or interfere with the carrying forward of the work of other Contractors.
- 2. In the event a dispute arises with respect to possible or alleged interference between Contractors which may retard the progress of the work, the dispute shall be heard and settled by the CM and Architect, whose decision as to the party or parties at fault, and as to the manner in which the matter may be settled, shall be binding and conclusive on all parties.

### END OF PROJECT COORDINATION

### SECTION 01200 PROJECT MEETINGS

- 1. The Construction Manager shall schedule and administer pre-bid meetings, preconstruction meetings, periodic progress meetings, and specially called meetings throughout the progress of the work. This responsibility includes:
  - a. Prepare agenda for meetings.
  - b. Make physical arrangements for meetings.
  - c. Preside at the meetings.
  - d. Record the minutes, including all significant proceedings and decisions.
  - e. Reproduce and distribute copies of minutes three (3) days after each meeting to go to the following:
    - I. All participants in the meeting.
    - ii. All parties affected by decisions made at the meeting.
    - iii. The Architect/Engineer and Owner.
- 2. Representatives of contractors, subcontractors and suppliers attending the meetings shall be qualified and authorized to act on behalf of the respective parties they each represent.
- 3. Architect/Engineer may attend meetings to ascertain that work is expedited consistent with the Contract Documents and Construction Schedule.

### PRE-BID MEETINGS

1. Meeting with interested key bidders shall be held after documents have been sent out and before the bid date. The purpose of the meeting is to answer questions generated by the Contractors' initial review of the bidding documents. The Owner, Architect/Engineer, and Construction Manager shall be on hand to answer questions. Bidders are urged to attend. Meeting minutes shall be issued as part of an addendum.

### **PRE-CONSTRUCTION MEETINGS**

1. Schedule within 15 days after date of Notice to Proceed.

2. Location: A central site, convenient for all parties, designated by the Construction Manager.

### 3. Attendance:

- a. Owner's Representative
- b. Architect/Engineer and his professional consultants
- c. Construction Manager
- d. Contractors and Major Suppliers
- e. Others as appropriate

### SECTION 01200 PROJECT MEETINGS

- 4. Suggested Agenda:
  - a. Distribution and discussion of:
    - I. List of major subcontractors and suppliers.
    - ii. Projected Construction Schedules.
  - b. Critical work sequencing.
  - c. Major equipment deliveries and priorities.
  - d. Project Coordination.
  - e. Procedures and processing of:
    - I. Field decisions
    - ii. Proposal requests
    - iii. Submittals
    - iv. Change Orders
    - v. Applications for payment
  - f. Adequacy of distribution of Contract Documents.
  - g. Procedures on maintaining documents.
  - h. Use of premises:
    - I. Office, work and storage area.
    - ii. Owner's requirements.
  - I. Construction facilities, controls and construction aids.
  - j. Temporary utilities.
  - k. Safety and first-aid procedures.
  - I. Security procedures.
  - m. Housekeeping procedures.

### PROGRESS MEETINGS

- 1. Schedule regular periodic meetings as required.
- 2. Hold called meetings as required by progress of work.
- 3. Location of the meetings: The project field office of the Construction Manager.
- 4. Attendance:
  - a. Architect/Engineer, or his professional consultants as needed.
  - b. Contractors as appropriate to the agenda.
  - c. Suppliers as appropriate to the agenda.
  - d. Others.
- 5. Suggested Agenda:
  - a. Review of work progress since previous meeting.
  - b. Field observations, problems, conflicts.
  - c. Problems which impede Construction Schedule.
  - d. Review of off-site fabrication and delivery schedules.
  - e. Corrective measures and procedures to regain projected schedule.
  - f. Coordination of schedules.

### SECTION 01200 PROJECT MEETINGS

- g. Review submittal schedules: Expedite as required.
- h. Review of work proposed before next meeting.
- 6. Attendance at progress meetings is considered a part of the performance of the contract. The purpose of this meeting is to schedule and coordinate the entire project. If a contractor or Material Supplier has been properly notified by the Construction Manager to attend said meeting and it is not attended by a representative of the Contractor or Material Supplier, familiar with this project, and with pertinent information concerning this project, payment can be withheld until such time as another meeting can be held.

### SECTION 01300 SUBMITTALS

- 1. Submit Shop Drawings, Product Data and Samples required by the Contract Documents. These items to be submitted to the Construction Manager.
- 2. <u>All</u> submittals shall be provided to the Construction Manager within 30 days of the contract award. Particular attention shall be taken to submit long lead time materials first, i.e., windows, electrical panels, mechanical equipment, hollow metal, finish hardware, etc. All items requiring color selection must be submitted at the earliest possible date to allow the Architect and the Owner to finalize color and finish choices.
- 3. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings. Copies of Contract Documents are not acceptable as shop drawings. Provide original drawings.
- 4. Product Data:
  - a. Clearly mark each copy to identify pertinent products or models.
  - b. Show performance characteristics and capacities.
  - c. Show dimensions and clearances required.
- 5. Manufacturer's standard schematic drawings and diagrams:
  - a. Modify drawings and diagrams to delete information which is not applicable to the work.
  - b. Supplement standard information to provide information specifically applicable to the work.
- 6. Submit samples of sufficient size and quantity to clearly illustrate:
  - a. Functional characteristics of the product with integrally related parts and attachment devices.
  - b. Full range of color, texture and pattern.

NOTE: All submittal information is to be received by the Construction Manager within thirty (30) days of the date of notice to proceed or contract date, whichever is the earliest date. Failure to comply with this requirement will be considered as a failure to properly perform and comply with the project schedule.

### DELEGATED-DESIGN SERVICES & SUBMITTALS

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

### SECTION 01300 SUBMITTALS

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

CONTRACTOR/SUPPLIER RESPONSIBILITIES

- 1. Review Shop Drawings, Product Data and Samples prior to submission.
- 2. Determine and verify:
  - a. Field measurements
  - b. Field construction criteria
  - c. Catalog numbers and similar data
  - d. Conformance with specifications
- 3. Coordinate each submittal with requirements of the work and of the Contract Documents.
- 4. Notify the Construction Manager and Architect/Engineer in writing, at the time of submission, of deviations in the submittals from requirements of the Contract Documents.
- 5. Begin no fabrication or work which requires submittals until return of submittals reviewed by the Architect/Engineer with approval noted.
- 6. Photo Copies of original contract documents will be rejected.

### SUBMISSION REQUIREMENTS

- 1. Make submittals promptly in accordance with approved schedule and in such sequence as to cause no delay in the work or in the work of other contractors. Incorrect submittals shall be returned without review.
- 2. Number of submittals required:
  - a. Shop Drawings: Submit the number of opaque reproductions which the Construction Manager requires, plus one copy which will be retained by the Architect/Engineer each. **A MINIMUM OF SEVEN SHALL BE REQUIRED.**
  - b. Product Data: Submit number of copies which the Construction Manager requires, plus two which will be retained by the Architect/Engineer. A MINIMUM OF SEVEN COPIES SHALL BE REQUIRED.
  - c. Samples: **TWO EACH.**
- 3. Submittals shall contain:
  - a. Date of submission and dates of previous submissions.
  - b. Project title and number.
  - c. Contract identification.
  - d. Names of:
    - i. Contractor
    - ii. Supplier
    - iii. Manufacturer
  - e. Identification of product with specification section number.
  - f. Field dimensions, clearly identified as such.

### SECTION 01300 SUBMITTALS

- g. Relation to adjacent or critical features of the work or materials.
- h. Applicable standards, such as ASTM or Federal Specifications numbers.
- i. Identification of deviations from Contract Documents.
- j. Identification of revisions on re-submittals.
- k. An 8" x 3" blank space for Contractor, Construction Manager, and Architect/Engineer stamps.
- I. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of information within the submittal with requirements of the work and Contract Documents.
- 4. Stamp of Architect or Consultant on returned shop drawings and samples shall be interpreted as follows:
  - a. No Exceptions Taken: No corrections, proceed with work.
  - b. Note Markings: Items marked up shall not be fabricated or furnished without incorporation of marks and notes.
  - c. Rejected: Item is rejected as not in accordance with contract requirements, or for other justified cause. Submission shall be revised and resubmitted. No item shall be fabricated or furnished under this stamp.
  - d. Confirm: Submit written verification that shop drawings and samples have been revised to comply with markings.
  - e. Resubmit: Submit revised Shop Drawings and Samples for review.
- 5. A Contractor or Material Supplier shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Construction Manager's and/or the Architect's review of Shop Drawings, Product Data or Samples unless the Contractor has specifically informed the Construction Manager and the Architect in writing of such deviation at the time of submission and the Construction Manager and Architect have given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's approval thereof.
- 6. Any Contractor or Material Supplier, upon the request from the Construction Manager, will provide adequate information to verify the quantity of specific materials which have been ordered for this project. This does not relieve the Contractor or Material Supplier of the responsibility of providing adequate materials on a timely basis to meet the project schedule.

### **RE-SUBMISSION REQUIREMENTS**

1. Make corrections or changes in submittals required by the Architect/Engineer and resubmit.

- 2. Shop Drawings and Product Data:
  - a. Revise initial drawings or data and re-submit as specified for initial submittal.
  - b. Indicate changes which have been made other than those requested by the Architect/Engineer.
#### SECTION 01300 SUBMITTALS

- 3. Samples: Submit new samples as required for initial submittal.
- 4. Resubmittals shall be made within two weeks of return of rejected submittals,

#### DISTRIBUTION BY CONSTRUCTION MANAGER

- 1. Distribute reproductions of Shop Drawings and copies of Product Data which carry the Architect/Engineer stamped no exceptions taken or note markings to:
  - a. Jobsite file.
  - b. Record documents file.
  - c. Other affected Contractors.
  - d. Owner
- 2. Distribute samples which carry the Architect/Engineer stamp of approval as directed by the Architect/Engineer.

#### **ARCHITECT/ENGINEER DUTIES**

- 1. Review submittals with reasonable promptness and in accordance with the schedule.
- 2. Affix stamp and initials or signature, and indicate requirements for re-submittal, or review of submittal.
- 3. Return submittals through Construction Manager for distribution, or for re-submission to Contractors and Material Suppliers.
- Note: Contractors to keep approved shop drawings on site at all times. (No Exceptions).

## SECTION 01400 CODES, STANDARDS, AND INDUSTRY SPECIFICATIONS

- 1. a. Material or operations specified by reference to published specifications of a manufacturer, testing agency, society, association or other published standards shall comply with requirements thereto in effect on date of Advertisement for Bidders.
  - b. Discrepancies between referenced codes, standards, specifications and Contract Documents shall be brought to the attention of the Construction Manager for clarification by the Design Team.
  - c. Material or work specified by reference to conform to a standard, code, law or regulation shall be governed by Contract Documents when they exceed requirements of such references; referenced standards shall govern when they exceed Contract Documents.
  - d. Proof of Compliance.

Whenever Contract Documents require that a product be in accordance with Federal Specification, ASTM designation, ANSI specification, or other association standard, at Architect's request, Contractor shall present an affidavit from manufacturer certifying that product complies therewith. Where requested or specified, submit supporting test data to substantiate.

#### MANUFACTURER'S DIRECTIONS

Utilize manufactured articles, materials and equipment as directed by manufacturer unless herein specified to contrary. Discrepancy between an installation required by Contract Documents and manufacturer's instructions and recommendations shall be resolved by Architect before work may proceed.

## QUALITY CONTROL AND TESTING LABORATORY SERVICES

The Owner will provide all testing services for required testing with the exception of Division 15000 and 16000. NOTE: It may not be the case that ALL non-MEP testing will be provided by the Owner, as there may be other required testing throughout the specifications. Contractor is responsible for any costs associated with re-testing should original tests fail.

## CONTRACTOR'S RESPONSIBILITY

1. Cooperate with laboratory personnel, provide access to work, and install work according to manufacturer's operations.

## SECTION 01400 CODES, STANDARDS, AND INDUSTRY SPECIFICATIONS

2. Secure and deliver to laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

- 3. Provide to laboratory preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
- 4. Furnish copies of Products test reports as required.
- 5. Furnish incidental labor and facilities:
  - a. To provide access to work to be tested.
  - b. To obtain and handle samples at project site, or at source of product to be tested.
  - c. To facilitate inspections and tests.
  - d. For storage and curing of test samples.
- 6. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of test.
- 7. Employ and pay for services of separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required:
  - a. For the Contractor's convenience.
  - b. When initial tests indicate work does not comply with the Contract Documents.
- 8. Promptly submit three (3) copies of written reports of all tests and inspections to Architect/Engineer and Construction Manager. Each report shall include:
  - a. Date issued.
  - b. Project title and number.
  - c. Testing laboratory name, address and telephone number.
  - d. Name and signature of laboratory inspector.
  - e. Date and time of sampling or inspection.
  - f. Record of temperature and weather conditions.
  - g. Date of test.
  - h. Identification of product and specification section.
  - i. Location of sample or test in the project.
  - j. Type of inspection or test.
  - k. Results of tests and compliance with Contract Documents.
  - I. Interpretation of test results, when requested by Architect/Engineer or Construction Manager.
  - m. Reports with incomplete information will be rejected and returned for corrections.

# SECTION 01400 CODES, STANDARDS, AND INDUSTRY SPECIFICATIONS

9. Incomplete reports may be rejected and payments may be withheld until corrected reports are submitted.

#### **SECTION 01420 - REFERENCES**

#### 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 **DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Subcontractor'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," "approved," "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. "Installer": Subcontractor or another entity engaged by Subcontractor as an employee or Sub-subcontractor to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

- J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- K. "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. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
  - 1. 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.
- D. Copies of Standards: Each entity engaged in construction on Project must 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 publication source and make them available on request.
- E. Abbreviations and Acronyms for 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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434
CFR	Code of Federal Regulations Available from Government Printing Office <u>www.access.gpo.gov/nara/cfr</u>	(888) 293-6498 (202) 512-1530
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	(601) 634-2355
DOD	Department of Defense Specifications and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MILSPEC	Military Specification and Standards Available from Defense Automated Printing Service www.astimage.daps.dla.mil/online	(215) 697-6257
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434

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#### 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 Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- 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-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials www.aashto.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AFPA	American Forest & Paper Association (See AF&PA)	

AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association www.hardboard.org	(847) 934-8800
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen) www.anla.org	(202) 789-2900
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600

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APA	Architectural Precast Association www.archprecast.org	(941) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ASCA	Architectural Spray Coaters Association www.ascassoc.com	(609) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and	(800) 527-4723
	www.ashrae.org	(404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(817) 326-6300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711

BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
222	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CCFSS	Center for Cold-Formed Steel Structures www.umr.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CGSB	Canadian General Standards Board www.pwgsc.gc.ca/cgsb	(819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176

CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
СТІ	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eifsfacts.com	(800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FSC	Forest Stewardship Council www.fsc.org	(612) 353-4511
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association) www.glasswebsite.com/gana	(785) 271-0208

GRI	Geosynthetic Research Institute www.drexel.edu/gri	(215) 895-2343
GTA	Glass Tempering Division of Glass Association of North America (See GANA)	
н	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (See CSA)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426

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ISSFA	International Solid Surface Fabricators Association	(702) 567-8150
I3A	International Imaging Industry Association (Formerly: PIMA - Photographic & Imaging Manufacturers Association) www.pima.net	(914) 698-7603
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
IWS	Insect Screening Weavers Association (Now defunct)	
КСМА	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association) www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
LSGA	Laminated Safety Glass Association (See GANA)	
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(614) 228-6194
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)	
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613

NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NAAMM	North American Association of Mirror Manufacturers (See GANA)	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NAMI	National Accreditation and Management Institute, Inc.	(304) 258-5100
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(414) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-6372

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NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSA	National Stone Association (See NSSGA)	
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association (Formerly: NSA - National Stone Association) www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo and Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (703) 779-1022
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
PGI	PVC Geomembrane Institute //pgi-tp.ce.uiuc.edu	(217) 333-3929
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400

RFCI	Resilient Floor Covering Institute www.rfci.com	Contact by mail only
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabfurn.com	(516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.screenmfgassociation.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/SPFD	Society of the Plastics Industry (The) Spray Polyurethane Foam Division (See SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 444-0242

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SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
ТСА	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 705-9898
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USITT	United States Institute for Theatre Technology, Inc. www.culturenet.ca/usitt	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (See WCSC)	

WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WIC	Woodwork Institute of California www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. www.bocai.org	(708) 799-2300
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449
ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533
SBCCI	Southern Building Code Congress International, Inc. www.sbcci.org	(205) 591-1853

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. Names, telephone numbers, and Web-site addresses

are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(202) 708-5082
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley Laboratory (See LBNL)	
LBNL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-5605
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934

USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

E. State 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. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CAPU (See CPUC) C

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Products Laboratory //txforestservice.tamu.edu	(936) 639-8180

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

## SECTION 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

GENERAL TEMPORARY UTILITIES SUPPORT FACILITIES AND INSTALLTION CONSTRUCTION AIDS USE OF PERMANENT SYSTEMS

# <u>GENERAL</u>

- 1. The following items apply to each individual Contractor as it pertains to their work, except as noted to be furnished by Construction Manager.
- 2. Barriers and Fire Protection: Bid Package #3
  - A. Provide suitable barriers and safety devices required to prevent public entry, worker safety, protect the work, existing facilities, trees and plants from construction.
  - B. Fencing: General Trade Contractor shall provide a new chain link fence for the project (see drawing). Fence shall be a minimum of 6' tall, 11 gauge chain link type with a continuous top rail. Posts shall be 2" diameter and spaced no more than 10' apart and placed in the ground. Two (2) double swing gates with a minimum 12'-0" opening shall be provided. Contractor shall provide two (2) padlocks and 8 keys (keyed alike) to the Construction Manager for distribution. Contractor shall inspect the conditions of the fencing on daily basis and assure the site is secure. Contractor shall include an allowance of \$1,000 for repairs to the construction fence at the direction of the Construction Manager.
  - C. Provide and install a fire extinguisher at each exit from every floor.
- 3. Temporary Storage Sheds (location determined by Construction Manager): All Bid Packages
  - A. Provide storage sheds to meet requirements of the various trades, with dimensions of sheds adequate for storage and handling of products. Provide ventilation adequate for products to be stored and to comply with code requirements. Maintain temperatures for products as specified and with the range recommended by manufacturer of products to be stored.
  - B. Contractor shall relocate temporary structures, sheds, trailers and materials in storage as often as required for construction progress or as directed by the Construction Manager.
  - C. Restore areas to original condition upon removal of trailer.
  - D. Existing Building <u>will not</u> be used as storage areas.

## SUPPORT FACILITIES INSTALLATION

4. Project Identification and Temporary Signs: Not Applicable – Provided in earlier Phase of Project

- A. Prepare project identification and other safety signs (Construction Entrance, Hard Hat Project, All visitors must check in with CM). Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit the installation of unauthorized signs.
- B. Engage an experienced sign painter to apply graphics for Project Identification signs.
  - 1. Provide 3 "Do Not Enter Construction Work" signs. Attach to each entrance gate/fence.
  - 2. Provide 3 "All visitors must report immediately to Codell Construction's trailer". Attach to each entrance gate/fence.
  - 3. Provide 3 "Hard Hat Project" signs. Attach to each entrance gate/fence.
- C. Provide and install a project sign of size, composition and color as provided by the Architect. Installation shall include all supporting framing and setting materials required to make the sign weather resistant and capable or withstanding normal environmental forces including rain, snow, ice and wind. Digitally printed sign, in UV resistant ink, shall be 8' w x 4' h on 4" x 4" posts set in 1' diameter holes 3'6" deep filled with concrete. Architect shall provide artwork to the contractor.

# 5. Waste Disposal Facilities: Bid Package #3

- A. Provide waste-collection containers in sizes adequate to handle waste from construction operations.
- B. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

# 6. Final Cleaning: **Bid Package #3**

- A. Final cleaning shall mean to clean by acceptable methods all interior and exterior surfaces so the project can be ready for use by the Owner.
- B. Remove labels that are not required as permanent labels.
- C. Clean transparent materials, including mirrors and window/door glass, to a polish condition, removing substances that are noticeable as vision obscuring materials.
- D. Clean exposed exterior and interior hard-surfaced finishes, to a dirt free condition, free of dust, stains, films and similar noticeable distracting substances. Restore reflective surfaces to original reflective conditions.
- E. Wipe surfaces of mechanical and electrical equipment clean; remove excess lubrication and other substances.
- F. Clean light fixtures and lamps so as to function with full efficiency.
- G. Clean project site (yard and grounds) involved in construction, including landscaped development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills and other foreign deposits. Rake grounds that are neither planted nor paved to a smooth even surface.
- H. Clean concrete floors in non-occupied spaces.
- I. Vacuum clean carpeted surfaces and similar soft surfaces and mop all floors surfaces.
- J. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.

K. Clean food service equipment to a condition of sanitation ready and acceptable for intended food service use.

## 7. Weekly Cleaning: All Bid Packages

A. Each trade on site is to supply one (1) man each week for cleanup. Failure to participate in the weekly cleanup session will result in a backcharge to the contractor. No exceptions! The Construction Manager will base the deductive change order (backcharge) on the prevailing wage rate plus 33% at a minimum of eight hours for each day missed. The Construction Manager will format and update a cleaning log for documentation which will require the contractor's initials for confirmation. Cleanup day will always be on a Thursday starting at 8:00 am and will conclude at the direction of the Construction Manager. Each contractor is responsible for supplying their own brooms and other tools to complete the work. The General Trades contractor will be responsible for providing the necessary amount of floor sweeping compound starting one week prior to the wall paint commencing and until the floor tile is complete.

## 8. Trash Cans: Bid Package #3

A. Provide five (5) - 55 gallon trash cans to be used throughout the project. Contractor is responsible for emptying these cans on daily basis. Coordinate with Construction Manager on location of cans.

# TEMPORARY UTILITIES

- 9. Temporary Sanitary Facilities: Bid Package #3
  - A. Comply with regulations and health codes for type, number, location, operation and maintenance of facilities.

## 10. Temporary Water: Bid Package #17

- A. Install branch piping with taps located so that water is available throughout the construction site by use of hoses. Protect piping and fittings against freezing.
- B. Contractor shall make arrangements and pay all fees for temporary water connections and comply with federal, state and local codes and regulations and with utility company requirements.
- C. Temporary water (metered) usage shall be paid for by the Owner.
- 11. Temporary Heat, Ventilation, Cooling and Humidity Control: Bid Package #3
  - A. Contractor is responsible for all aspects of temporarily enclosing the building including but not limited to window openings, door openings, louver openings etc... Maintenance of this work shall also be accounted for in the bid. Contractor must use reinforced plastic, plywood and/or drywall as the bulk material. The Contractor shall reference the schedule to determine if and when temporary enclosures are required. Temporary enclosure must occur if a successor task(s) on the schedule requires a minimum heat or cooling temperature (drywall mud etc...) in order to

complete the work. The Construction Manager and Contractor will coordinate the commencement/removal of all temporary enclosures. Any contractor found intentionally damaging the temporary enclosures will replace them at their own expense.

- B. Contractor is responsible for the temporary heating/cooling/humidity devices necessary for the project.
- C. The owner will pay for the cost of metered gas. Contractor to provide temporary means of hookup and hoses to natural gas service.

# 12. Temporary Electric: Bid Package #18

- A. Contractor shall provide temporary service and hookup to the Construction Manager's trailer.
- B. Within the building, the Contractor shall provide, until substantial completion, all wiring, switches, sockets, lamps and similar equipment required for temporary lighting. Temporary lighting shall be sufficient to enable all trades to complete their work and to enable the Architect and Construction Manager to check all work as it is being done.
- C. Provide a minimum of one outlet for power tools, masonry saw and like tools for each 1,000 sq. ft. of floor space.
- D. Temporary electric connections and installation shall be paid for by the installing contractor.
- E. Temporary electric (metered) usage shall be paid for by the Owner.
- F. Comply with federal, state and local codes and regulations and with utility company requirements.

# CONSTRUCTION AIDS

- 13. Provide construction aids and equipment required by personnel and to facilitate the execution of the work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment.
- 14. Removal: Shall be by each respective Contractor responsible for original installation. Restore permanent facilities used for temporary services to specified conditions. Clean and repair damage caused by installation or by use of temporary facilities. Grade areas of site affected by temporary installations to required elevations and slopes and clean area.

# USE OF PERMANENT SYSTEMS

- 15. Temporary Use of Equipment:
  - A. The permanent heating, plumbing and electrical equipment, when installed, may be used for temporary services, subject to the approval of the Architect and CM. Should the permanent systems be used for this purpose, the appropriate contractor will pay for all temporary connections required. Contractor shall also make any replacement required due to damage, without cost.
  - B. The responsible contractor shall assume all costs of leaving the same in "as new" condition. Cost of fuel consumed during construction will be by the Owner. At the time of acceptance of the system by the Architect/Engineer,

all construction filters and other temporary items will be removed and replaced with new.

## PROJECT RULES

- 16. Eating, Drinking & Tobacco Products:
  - A. The Construction Manager will designate an area within the building for eating and drinking. No eating or drinking will be permitted outside of these designated areas other than drinking water.
  - B. The use of tobacco products will not be permitted within the building once the building is enclosed. The Construction Manager will post signs and notify all contractors of when the no smoking policy is in effect. One warning will be applied to an individual with the second instance resulting in removal from the project.

# **PUNCHLIST**

- 17. Punchlist Manager: All Bid Packages
  - A. Each contractor is to provide a punchlist manager. The punchlist manager must be on site full time once punchlist work commences. The manager must have a history with the project and must be able to complete the punchlist and provide updates to the Construction Manager.
  - B. If punchlist work is not 100% complete within (20) twenty working days from receipt of punchlist the Owner/CM will complete the work at the expense of the contractor.

## SECTION 01600 PROJECT AS-BUILT DOCUMENTS

- 1. Throughout progress of the work, each Contractor shall maintain an accurate As-Built of all changes in the Contact Documents.
- 2. As the work progresses on these contracts, As-Built changes on a set of As-Built Documents.
- 3. Each Contractor shall delegate the responsibility for maintenance of As-Built Documents to one person on the Contractor's staff as approved in advance by the CM.
- 4. Thoroughly coordinate all changes within the As-Built Documents, making adequate and proper entries on each page of specifications and each sheet is required to properly show the change. Accuracy of As-Builts shall be such that future search for items shown in the Contract Documents may reasonably rely on information obtained from the approved As-Built Documents. Make all entries within 24 hours after receipt of information.
- 5. The Architect/Engineer's approval of the current status of As-Built Documents will be a prerequisite of the CM and Architect/Engineer's approval of requests for progress payment and request for final payment under the Contract.
- 6. Prior to submitting request for final payment, submit the final As-Built Documents to the Architect through the CM for approval. Incomplete As-Built Drawings shall be cause to withhold final payment.
- 7. Use all means necessary to maintain the job set of As-Built Documents completely protected from deterioration and from loss and damage until completion of the work.
- 8. Immediately upon award and start of the job, identify one of the Documents with the title "As-Built Document Job Set".
- 9. Preservation:
  - a. Do not use the job set for any purpose except entry of new data and for review by the Architect/Engineer, until start or transfer of data to final As-Built Documents.
  - b. Maintain the job set at the site of work.
- 10. When making entries on drawings use an erasable colored pencil (not ink or indelible pencil), clearly describe the change by note and by graphic line, as required. Date all entries. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

## SECTION 01600 PROJECT AS-BUILT DOCUMENTS

- 11. Final As-Built Documents: The purpose of the final As-Built Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed without lengthy and expensive site measurement, investigation and examination. All final As-Built Drawings shall include <u>all</u> changes on Project by Addenda, ASI, and Change Order. All supplemental drawings shall be mounted on back of previous page.
- 12. If the As-Built Documents have been kept in good condition during progress of the work, and if entries are sufficient and orderly, thereon to the approval of the Architect/Engineer, the job set of those Documents will be accepted by the CM as final As-Built Documents for those Documents. If any such Document is not so approved by the CM, secure a new copy of that Document from the Architect/Engineer, paying the total charge for reproduction; carefully transfer the change data to the new copy and submit for approval of the CM and Architect/Engineer. (No Exceptions).
- 13. As-Built Document Submittal: As-Built Drawings: As-Built drawings shall reflect changes to the work and its equipment.

Contractor shall maintain one complete set of blackline prints at the job site as As-Built drawings and shall As-Built thereon clearly and neatly, in colored pencil, changes as indicated above. These prints shall not be used for construction purposes and shall be kept current with the progress of the work.

14. Final Payment will not be released to Contractor until an acceptable set of As-Built Documents has been presented to the CM and Architect.

## SECTION 01650 PROGRESS PAYMENT AND CONTRACT CLOSE-OUT DOCUMENTS

- 1. Immediately after award of the contacts, the CM shall send all Contractors and Material Suppliers payment request forms. A schedule of values shall be completed and returned to the CM and Architect for approval two weeks before any payment applications are submitted. Applications will not be reviewed until Schedule of Values is approved. All amounts on the schedule of values shall be stated to the nearest dollar.
- 2. Payment applications will be accepted only on a copy of the forms supplied by the CM and enclosed in the Project Information Package, which will be sent to all Contractors and Material Suppliers immediately after award of the contracts.
- 3. Payments to the Contractors and Material Suppliers will be in accordance with Article No. 9 of the General Conditions.
- 4. When the Contractor considers the work to be substantially complete as outlined by the General Conditions of the Contract, the Contractor shall submit a written declaration of consideration to the Construction Manager along with a request for inspection. If, in the judgement of the Construction Manager, the request is justified the Architect will be notified in writing and an inspection scheduled.
- 5. The Construction Manager will then provide the Contractor with forms to be executed by the Contractor, the Surety Company, Subcontractors, Material Suppliers, and others, as deemed necessary by the contract.
- 6. The Architect, accompanied by the Construction Manager will conduct a review of the work. If the Architect considers the work to be substantially complete the Architect will complete a Certificate of Substantial Completion form and forward to the Owner, with a copy to the Construction Manager. The Owner may or may not conduct their own inspection.

A list of any deficiencies and/or non-conforming work will be prepared and sent to the Contractor for corrections. The Contractor shall complete all punch list items within 30 (thirty) days after the Construction Manager reviews the substantial completion punch list. If the Contractor does not complete the punch list items within 30 (thirty) days, this shall be interpreted to mean the Contractor does not want to complete the punch list items, and the Contractor shall agree that the Owner will deduct from any monies remaining in the Contractor's contract an amount sufficient to obtain another contractor to complete the punch list items. When all items have been corrected, the Architect will then prepare a Certificate of Substantial Completion with copies being forwarded to the Owner, the Construction Manager, and the Contractor.

7. Upon receipt of the Certificate of Substantial Completion, the Contractor may make application for the balance of the amount due on the Contract less 5% retainage.

When the Contractor judges the work to be near completion, a written declaration so stating shall be submitted to the Construction Manager accompanied by a list of outstanding items to be completed. The Construction Manager will promptly prepare a list of items to be

## SECTION 01650 PROGRESS PAYMENT AND CONTRACT CLOSE-OUT DOCUMENTS

corrected prior to the request for final completion. Contractor's request for final inspection will not be considered until the Contractor's list of outstanding items and the Construction Manager's list has been completed.

- 9. When the Contractor judges the work to be at final completion, a written declaration so stating shall be submitted to the Construction Manager accompanied by the following documents:
  - a. Consent of Surety Company to Final Payment
  - b. Contractor's Affidavit of Debts and Claims
  - c. Release and Waivers of Lien from Subcontractors and Material Suppliers to the extent required by the Owner
  - d. Final "As Built" Drawings
  - e. Operating and Maintenance Manuals
  - f. Warranties and Guarantees
  - g. Final Application for Payment
  - h. Copy of the "Punch List" with all items dated and signed by the Contractor's on-site representative as being completed and/or corrected.
- 10. When all the above documents have been judged to be in order and forwarded to the Architect, a final inspection will be conducted by the Architect, accompanied by the Construction Manager. When the Architect finds that all work under the contract is completed and satisfactorily performed, the Architect will notify the Owner and Construction Manager in writing and certify the Contractor's final Application for Payment.
- 11. Release of Final Payment is contingent upon approval by the Owner, following their on-site review of the Project.

END OF PROGRESS PAYMENTS AND CONTRACT CLOSE-OUT PROCEDURES

## SECTION 01700 CUTTING AND PATCHING

- 1. Each Contractor, or appropriate Subcontractor, is responsible for cutting, fitting, and patching required to complete the work, or to:
  - a. Make its several parts fit together properly.
  - b. Uncover portions of the work to provide for installation of ill-timed work.
  - c. Remove and replace defective work.
  - d. Remove and replace work not conforming to requirements of the Contract Documents.
  - e. Remove samples of installed work as specified for testing.
  - f. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- 2. Related requirements of other parts of the Project Manual: For basic responsibility of parties to the Contract, refer to the Condition of the Contract.
- 3. Submit written request to CM and Architect/Engineer well in advance of executing cutting or alteration which affects:
  - a. Work of the Owner or separate contractor.
  - b. Structural value or integrity of any element of the Project.
  - c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
  - d. Efficiency, operational life, maintenance or safety of operational elements.
  - e. Visual qualities of sight-exposed elements.
- 4. Request pursuant to Section 01700 (3) shall include:
  - a. Identification of the Project.
  - b. Description of affected work.
  - c. Necessity for cutting, alteration or excavating.
  - d. Effect on work of the Owner or any separate contractor, or on the structural or weather-proof integrity of the Project.
  - e. Description of proposed work;
    - i. Scope of cutting, patching, alteration or excavating.
    - ii. Trades who will execute work.
    - iii. Products proposed.
    - iv. Extent of refinishing.
  - f. Alternatives to cutting and patching.
  - g. Cost proposal, when applicable.
  - h. Written permission of affected separate contractors.
- 5. Submit written notice to CM and Architect/Engineer designating date and time work will be uncovered.
- 6. Comply with specifications and standards for each specific product involved.
- 7. Inspect existing conditions of the Project, including elements subject to damage or to movement during cutting and patching.
- 8. After uncovering work, inspect conditions affecting installation of products, or performance of work.
- 9. Report unsatisfactory or questionable conditions to the Architect/Engineer in writing. Do not

## SECTION 01700 CUTTING AND PATCHING

proceed with work until the Architect/Engineer has provided further instructions.

- 10. Provide adequate temporary support as necessary to assure the structural value or integrity of the affected portion of the work.
- 11. Provide devices and methods to protect other portions of the Project from damage.
- 12. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.
- 13. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs.
- 14 Execute excavating and backfilling by methods which will prevent settlement or damage to other work.
- 15. Employ the original Installer or Fabricator to perform cutting and patching for (
  - a. Weather-exposed or moisture-resistant elements.
  - b. Sight-exposed finished surfaces.
- 16. Execute fitting and adjustment of products to provide finished installation to comply with specified products, functions, tolerances, and finishes.
- 17. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.
- 18. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- 19. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
  - a. For continuous surfaces, refinish to nearest intersection.
  - b. For an assembly, refinish the entire unit.

## SECTION 01710 CLEANING

- 1. Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this section. This will apply to <u>all</u> Contractors and their subs.
- 2. CM will conduct daily inspections, and more often if necessary to verify the requirements of cleanliness are being met.
- 3. All Contractors or subcontractors shall provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.
- 4. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Architect/Engineer.
- 5. General Progress Cleaning
  - a. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
  - b. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work.
  - c. At least weekly, and more often if necessary, completely remove all scrap, debris and waste material from the jobsite, including trash and garbage from lunches.
  - d. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.
- 6. Site Progress Cleaning
  - a. Daily, and more often if necessary, inspect the site and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage.
  - b. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site, restack, tidy, or otherwise service all arrangements.
  - c. Maintain the site in a neat and orderly condition at all times.
- 7. Structures Progress Cleaning
  - a. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris and waste material. Remove all such items to the place designated for their storage and/or disposal.
  - b. Weekly, and more often if necessary, sweep all interior spaces clean. "Clean" for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of handheld broom and reasonable effort.
  - c. As required preparatory to installation of succeeding materials, clean the structure or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
  - d. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in

## SECTION 01710 CLEANING

which finish materials have been installed. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the CM, may be injurious to the finish floor material.

- 8. Prior to completion of the work, remove from the jobsite all tools, surplus materials (except for surplus materials required to be turned over to the owner) and equipment.
- 9. Contractors failing to meet acceptable housekeeping requirements shall be charged for cleaning services arranged for by the CM. A deductive Change Order will be prepared.

## SECTION 01900 LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

- 1. This section of the specifications is the description of individual breakdowns for Bids to be submitted by Contractors and Material Suppliers.
- 2. All Bidders shall consult the General, Supplementary, and Special Conditions, all Plans, all Specifications and Addenda for items relating to their Bids.
- 3. Each individual Contractor will be responsible for the regrading or patching of areas disturbed by the processing of their work. The regraded areas shall be brought to proper subgrade or finish grade elevations depending on condition prior to the start of their work and properly compacted if required. Patched areas shall match pre-existing conditions. See Section 01700 "Cutting and Patching".
- 4. As provided by KRS 139.310 and Kentucky Administrative Regulation 103 KAR 26:070 (Contract Construction), each contractor is responsible for Kentucky Sales and Use Tax on all materials purchased and installed by the contractor or a third party hired by the contractor. For those bid packages identified as Supplier Only or Contractor/Supplier (containing bid breakout items), the sales and use tax is to be excluded only on those material items purchased by the Owner directly from the material supplier. If a contractor lists his own company as the supplier on those bid packages containing bid breakout items, the Owner will not issue a purchase order and exemption certificate. Accordingly, the sales and use tax on the materials used to fulfill the terms of the contract will be the liability of the contractor.
- 5. If a bidder bids a combination bid package which consists of <u>ALL</u> bid packages, Kentucky sales tax shall be included in bid
- 6. A Material Supplier is a person or organization who has a direct Purchase Order responsibility to the Owner. A Material Supplier cannot be an installing contractor. Purchase Order amount as bid will include all cost of delivery to the jobsite. Material Supplier assumes all responsibility for materials until delivery is accepted. Material Supplier will guarantee all materials furnished under a purchase order to be in accordance with the requirements of the contract documents. This guarantee shall extend through the construction period and one (1) year from the date of substantial completion of the project. *Material Suppliers shall not require the Owner to complete any form of credit application.* The designated Contractor or Subcontractor responsible for installation of Purchase Order material or equipment is to supervise and accept delivery, unload, handle, store, layout and install the items. Upon delivery, the designated contractor is to verify product suitability, quantity, quality and condition as soon as it can be ascertained and shall accept care, custody and control responsibility as if it were his own purchase. Any damage or loss after acceptance will be the responsibility of the designated contractor.
- 7. All Contractors and/or Material Suppliers other than the material suppliers providing breakout materials in accordance with Item #9 in this section will be required to execute and furnish Bonds as stated in the Project Manual in the amount of one hundred percent (100%) of the Contract or Purchase Order sum. This Bond shall be executed by a Surety Company authorized to do business in the State of Kentucky. The Bonding Company's premium shall be paid by the Contractor and/or Material Supplier. The Performance and Payment Bond shall include the name and Kentucky address of the Surety's resident agent or Attorney-in-Fact.
- 8. Protection of the Work of Others Contractors shall consider protection of finished work of prime importance. Care shall be taken by Contractors not to damage completed work of other

1

## SECTION 01900 LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

contractors, and to provide adequate protection for their own completed work. Any Contractor moving men and/or transporting materials across floors, grades, roofs or other vulnerable surfaces and through existing areas, shall provide adequate surface protection to prevent damage to existing surfaces. Any cost of damages will be borne by the Contractor causing said damage at the cost of replacement by the Contractor who installed the original material.

9. The Contractor/Supplier or Supplier Only Bidder will provide with their bid a breakdown of major material items (excluding sales tax). This breakdown shall include description of the item, name of the manufacturer, name of the supplier and the amount of the supplier's quote. The Owner will issue a purchase order direct to the supplier for these materials.

The Contractor shall also guarantee and warrant to the Owner that all described materials listed by the contractor in the breakdown (Section 00201) to be purchased directly by the Owner by purchase order shall fully conform to the requirements of the Contract Documents and that the quantity of such material is sufficient to complete this Bid Division. The Performance and Payment Bond required of the Contractor shall be in the combined amount of the materials designated in the bid to be acquired by Purchase Order by the Owner and all remaining items of cost specified in the respective Bid Division. Contractor will provide an invoice from the supplier to the Owner with Contractor's application for payment.

If material is surplus or unneeded at the completion of the project, then either a credit to Owner for the value of the unused material shall be issued by a deductive change order to the related purchase order, or the Owner may choose to keep the material

- 10. The language of the bid divisions is designed to outline and define the work in general to be included in a particular bid division and to prevent overlapping and conflicting requirements within other bid divisions. No Bidder shall use the omission of any item from this language as a basis for a claim for additional cost when such item is specified and/or shown on the drawings to be a part of a complete and workable system.
- 11. It shall be the responsibility of the bidder to determine which Bid Division or combination of Bid Divisions the Bidder desires to bid.
- 12. <u>All Contractors shall review all drawings and specifications for any work that may be</u> required whether specifically noted in a particular bid division or not.
# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #2 - PAVING**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

321216 Asphalt Paving

- 321313 Concrete Paving (Curb and Gutter and Pavement Markings)
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

CONCRETE

ASPHALT PAVEMENT MARKING PAINT STONE

# **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

### **BID PACKAGE: #3 – GENERAL TRADES**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 024660 Rammed Aggregate Piers

033000 Cast-in-Place Concrete (All except mechanical, plumbing, fire protection and electrical work)

- 061053 Miscellaneous Rough Carpentry
- 061600 Sheathing
- 064116 Plastic Laminate Faced Architectural Cabinets
- 066400 Plastic Paneling
- 071326 Self Adhere Sheet Waterproofing (All except masonry walls)
- 072100 Thermal Insulation (Rigid perimeter and under slab on grade only)
- 072201 Bituminous Membrane Thermal Insulation
- 072500 Weather Barriers
- 072726 Fluid Applied Membrane Air Barriers
- 078413 Penetration Firestopping (All except penetrations for elevator, fire protection, mechanical, plumbing and electrical work)

078446 Fire-Resistive Joint Systems (All except penetrations for elevator, fire protection, mechanical, plumbing and electrical work)

079200 Joint Sealants (For countertops, casework, solid surface materials and exterior site concrete only)

- 079500 Expansion Control
- 081113 Hollow Metal Doors and Frames
- 081416 Flush Wood Doors
- 083113 Access Doors and Frames
- 083300 Tornado Coiling Door
- 083313 Coiling Counter Doors

087100 Door Hardware (All except rough in of conduit for electrified hardware)

- 097723 Fabric Wrapped Panels
- 098433 Sound Absorbing Wall Units
- 098436 Sound Absorbing Ceiling Units
- 101100 Visual Display Units
- 101423 Panel Signage
- 102113.17 Phenolic Core Toilet Compartments

- 102123 Cubical Curtains and Tracks
- 102600 Wall and Door Protection
- 102800 Toilet, Bath and Laundry Accessories
- 104413 Fire Extinguisher Cabinets
- 104416 Fire Extinguishers
- 105113 Metal Lockers
- 105300 Pre-Engineered Aluminum Walkways
- 107516 Ground Set Flagpoles
- 116000 Stage Curtains
- 116623 Gymnasium Equipment
- 116800 Playfield Equipment and Structures
- 122413 Roller Window Shades
- 123623.13 Plastic Laminate Clad Countertops
- 123661 Simulated Stone Countertops
- 124813 Entrance Floor Mats and Frames
- 129300 Site Furnishings
- 311000 Site Clearing
- 312000 Earth Moving
- 321313 Concrete Paving (All except curb and gutter and pavement markings)
- 321373 Concrete Paving Joint Sealants
- 321400 Unit Paving
- 323113 Chain Link Fence and Gates
- 329113 Soil Preparation
- 329200 Turf and Grasses
- 329300 Plants
- 330500 Common Work Resulting from Utilities
- 334100 Storm Drainage Drainage Piping
- 334600 Subdrainage
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades
- 6. Contractor is responsible for grouting under column base plates.
- 7. Contactor to coordinate with BP #11 for concrete flatness requirements of slab on grade at wood flooring areas. BP #3 is responsible for concrete installation and flattness requirements.

#### BREAKOUT ITEMS:

ALUMINUM CANOPIES CASEWORK FENCES AND GATES FIRE EXTINGUISHERS AND CABINETS HARDWARE BUILDING INSULATION CONCRETE FIRE / WATER VAULT FOLDING PANEL PARTITIONS HOLLOW CORE PLANKS INSULATED CONCRETE FORMS LOCKERS HOLLOW METAL DOORS AND FRAMES JOINT SEALANTS LOUVER BLINDS SIGNAGE STONE STORM PIPE VISUAL DISPLAY BOARDS WOOD DOORS EROSION CONTROL LUMBER TUBULAR DAYLIGHT DEVICES OVERHEAD COILING DOORS SOLID SURFACE COUNTERTOPS STORM DRAINS/MANHOLES/ETC. TOILET AND BATH ACCESSORIES WOOD ATHLETIC EQUIPMENT LAWNS AND GRASSES REBAR

#### **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.

# 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

### **BID PACKAGE: #4 - MASONRY**

#### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 042000 Unit Masonry Assemblies
- 072201 Bituminous Membrane Thermal Insulation (At masonry assemblies only)

07190 Water Repellents

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

#### BREAKOUT ITEMS:

BRICK CMU MASONRY ACCESSORIES SAND WATER REPELLANTS CAST STONE DAMPPROOFING MORTAR AND GROUT TIES AND ANCHORS

#### **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #5 – STRUCTURAL STEEL**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 051200 Structural Steel Framing
  - 052100 Steel Joist Framing
  - 053100 Steel Decking
  - 055000 Metal Fabrications
  - 055100 Metal Stairs
  - 055213 Pipe and Tube Railings
  - 057313 Decorative Metal Railings
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades
- 6. Contractor is responsible to coordinate with BP #3 for grouting under column base plates. BP #3 to grout under base plates

# BREAKOUT ITEMS:

HANDRAILS AND RAILINGS STAIRS AND RAILS STEEL JOISTS METAL FABRICATIONS STEEL DECK STRUCTURAL STEEL

# **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

Bidder is advised that all work to be performed will be governed solely by the plans, specifications and addenda. Bidder is directed to the above specification

sections for technical information and any additional items of work involved. Special attention is directed to Section 01900, page 2, #11

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #7 – ALUMINUM WINDOWS AND STOREFRONT**

#### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 079200 Joint Sealants (At Perimeter of all installed materials)
  - 084113 Aluminum Framed Entrances and Storefront
  - 084413 Glazed Aluminum Curtain Wall
  - 088000 Glazing
  - 089000 Louvers and Vents
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

ALUMINUM ENTRANCES AND STOREFRONTS GLASS AND GLAZING JOINT SEALANTS ALUMINUM WINDOWS INSULATED TRANSLUCENT SANDWICH PANEL SYSTEM

#### **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #8 – GYPSUM BOARD ASSEMBLIES AND CEILINGS**

### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

072100 Thermal Insulation (All except rigid board insulation at slab on grade)

- 090561.13 Moisture Vapor Emission Control
- 092216 Non-Structural Metal Framing
- 092900 Gypsum Board
- 095000 Acoustical Wood Ceilings
- 095113 Acoustical Panel Ceilings
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

ACOUSTIC CEILING TILE AND GRID GYPSUM BOARD ACCESSORIES

#### BUILDING INSULATION GYPSUM BOARD ASSEMBLIES

# SPECIAL INSTRUCTIONS:

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

### BID PACKAGE: # 9 - TILE

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

093013 Ceramic Tiling

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

# TILE & ACCESSORIES

### **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.

# 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: # 10 – CARPET AND RESILIENT FLOOING**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 096513 Resilient Base and Accessories
  - 096543 Linoleum Flooring
  - 096813 Tile Carpeting
  - 096816 Sheet Carpeting
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

BASE AND ACCESSORIES	CARPET
FLOOR TILE	MASTIC

# **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: # 12 – PAINT AND SEALANTS**

#### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

079200 Joint Sealants (All except countertops, casework, solid surface materials, exterior site concrete, roof, aluminum windows, storefront, wall panels and toilet fixtures)

099113 Exterior Painting 099123 Interior Painting

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades
- 6. Contractor is responsible to coordinate with BP #16 requirements of painting of sprinkler pipe as called for in specifications. BP #12 is responsible to paint sprinkler pipe.

#### BREAKOUT ITEMS:

JOINT SEALANTS STAIN / SEALER

# PAINT & COATINGS

#### SPECIAL INSTRUCTIONS:

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #14 - BLEACHERS**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

126600 Telescoping Stands

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

# BLEACHERS

# **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.

# 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #15 - ELEVATOR**

### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:
  - 078413 Penetration Firestopping (For elevator work)
  - 078446 Fire-Resistive Joint Systems (For elevator work)
  - 142400 Machine Room-Less Hydraulic Elevator
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

# ELEVATOR & EQUIPMENT

# SPECIAL INSTRUCTIONS:

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.

# 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #11 – WOOD FLOORING**

#### INCLUDED:

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

096466 Wood Athletic Flooring

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades
- 6. Contactor to coordinate with BP #3 for concrete flatness requirements of slab on grade at wood flooring areas. BP #3 is responsible for concrete installation and flattness requirements.

# BREAKOUT ITEMS:

LUMBER WOOD FLOORING

# PAINT & COATINGS

# SPECIAL INSTRUCTIONS:

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: # 17 – MECHANICAL AND PLUMBING**

#### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

Special Conditions Relative to Site Work (For domestic and sanitary 02001 sewer systems, all mechanical and plumbing work) Excavation, Backfilling and Compacting for Utilities (For domestic 02222 water and sanitary sewer work) Sewer Structures (For sanitary sewer system) 02605 02660 Water Distribution System (For domestic water service) 02730 Sanitary Sewer System 02750 Sewer Force Main 03300 Cast-In-Place Concrete (For Mechanical and Plumbing Work) 07720 Roof Accessories (For Mechanical and Plumbing Work) 078413 Penetration Firestopping (For Mechanical and Plumbing Work) Fire-Resistive Joint Systems (For Mechanical and Plumbing Work) 078446 079200 Joint Sealants (For Mechanical and Plumbing Work) Division 20 – Geothermal Complete Division 22 – Plumbing Complete Division 23 - HVAC Complete

330500 Common Work Resulting from Utilities

- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

# CONTROLS

# DUCTWORK

DUCTWORK INSULATION	EQUIPMENT
GEOTHERMAL LOOP PIPING	GRD'S
SYSTEM	JOINT SEALANTS
HYDRONIC PIPE AND SPECIALTIES	PIPE INSULATION
MANHOLES AND STRUCTURES	PLUMBING ACCESSORIES
PIPE, FITTINGS AND PIPE SUPPORTS	ROOF
PLUMBING FIXTURES	STONE
ROOF CURBS	LIFT STATION
VAULT	SANITARY SEWER PIPE AND
DOMESTIC WATER PIPING	FITTINGS

#### **SPECIAL INSTRUCTIONS:**

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# LANGUAGE SPECIFIC TO INDIVIDUAL BIDS

# (CONTRACTOR / SUPPLIER)

# **BID PACKAGE: #6 - ROOFING**

#### **INCLUDED:**

- 1. The requirements of all Division 0 and Division 1 Sections apply to this and all Contract Packages.
- 2. Furnish, install and warrant all work shown on the drawings and described in the following specification sections:

072200	Standing Seam Roofing Insulation
074100	Standing Seam Metal Roofing
074213.13	Metal Wall Panels
074293.53	Metal Soffit Panels
075250	Modified Bituminous Membrane Roofing
076200	Sheet Metal Flashing and Trim
077100	Roof Specialties
077129	Manufactured Roof Expansion Joints
077200	Roof Accessories
077616	Roof Decking Pavers

- 079200 Joint Sealants (For all Roofing and wall panel work)
- 3. Layout
- 4. Cleanup
- 5. Coordination with other trades

# BREAKOUT ITEMS:

INSULATION MEMBRANE ROOFING ROOF SHEET METAL, FLASHING, AND TRIM STANDING SEAM METAL ROOF JOINT SEALANTS METAL WALL PANELS ROOF ACCESSORIES SOFFIT VENTS

# SPECIAL INSTRUCTIONS:

- 1. Refer to Alternates Section 01030. It is the responsibility of the Bidder to determine if any alternates are applicable to their bid.
- 2. Review all pages of the plans and specifications to ensure coordination of your work with other trades.
- 3. REFER TO THE FRONT OF SECTION 01900-LANGUAGE SPECIFIC TO INDIVIDUAL BIDS-ITEMS 1 THROUGH 11.

# TABLE OF CONTENTS

# Index of Drawings

Division	Section Title	Pages

### SPECIFICATIONS GROUP

DIVISION 01 - GENERAL REQUIREMENTS   012100 ALLOWANCES   012200 UNIT PRICES   012300 ALTERNATES	2 2 3
DIVISION 02 – EXISTING CONDITIONS 024660 RAMMED AGGREGATE PIERS	9
DIVISION 03 – CONCRETE 033000 CAST-IN-PLACE CONCRETE	18
DIVISION 04 – MASONRY 042000 UNIT MASONRY	18
DIVISION 05 - METALS051200STRUCTURAL STEEL FRAMING052100STEEL JOIST FRAMING053100STEEL DECKING054000COLD-FORMED METAL FRAMING055000METAL FABRICATIONS055100METAL STAIRS055213PIPE AND TUBE RAILINGS055813COLUMN COVERS057313DECORATIVE METAL RAILINGS	9 18 18 18 7 7 7 7
DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES 061053 MISCELLANEOUS ROUGH CARPENTRY 061600 SHEATHING 064116 PLASTIC-LAMINATE FACED ARCHITECTURAL CABINETS 066400 PLASTIC PANELING	7 5 6
DIVISION 07 - THERMAL AND MOISTURE PROTECTION07132607100THERMAL INSULATION072200STANDING SEAM ROOFING INSULATION072201BITUMINOUS MEMBRANE THERMAL INSULATION	5 5

#### INDEX OF DRAWINGS

GENERAL

- Cover COVER
- G1.1 LIFE SAFETY PLANS AND BUILDING CODE SUMMARY
- G1.2 GENERAL PROJECT INFORMATION
- G2.1 TORNADO SAFE ROOM PLAN

CIVIL

- C0.1 GENERAL NOTES & LEGEND
- C1.1 EXISTING CONDITIONS
- C2.1 DEMOLITION PLAN
- C2.2 DEMOLITION PLAN
- C3.1 OVERALL SITE LAYOUT
- C3.2 SITE LAYOUT
- C3.3 SITE LAYOUT
- C3.4 SITE LAYOUT
- C4.1 OVERALL GRADING LAYOUT
- C4.2 GRADING PLAN
- C4.3 GRADING PLAN
- C4.4 GRADING PLAN
- C5.1 OVERALL EPSC PLAN
- C5.2 SWPPP
- C6.1 UTILITY PLAN
- C7.1 CONSTRUCTION DETAILS
- C7.2 CONSTRUCTION DETAILS
- C7.3 CONSTRUCTION DETAILS

LANDSCAPE

- L1.1 LANDSCAPE PLAN AND PLANT SCHEDULE
- L1.2 LANDSCAPE DETAILS

ARCHITECTURAL

- A1.1 FIRST FLOOR PLAN AREA A
- A1.2 FIRST FLOOR PLAN AREA B
- A1.3 SECOND FLOOR PLAN
- A1.4 MECHANICAL PLATFORM FLOOR PLAN
- A3.1 RCP FIRST FLOOR AREA A
- A3.2 RCP FIRST FLOOR AREA B
- A3.3 RCP SECOND FLOOR
- A3.4 CEILING DETAILS
- A4.1 ROOF PLAN, DETAILS
- A4.2 ROOF DETAILS
- A4.3 ROOF DETAILS
- A4.4 ADMIN ROOF PLAN / DETAILS
- A5.1 EXTERIOR ELEVATIONS
- A5.2 EXTERIOR ELEVATIONS
- A6.1 BUILDING SECTIONS
- A6.2 BUILDING SECTIONS AND 3D PERSPECTIVES
- A6.3 WALL SECTIONS
- A6.4 WALL SECTIONS
- A6.5 WALL SECTIONS

A6.6 WALL SECTIONS	
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- A6.7 WALL SECTIONS
- A6.8 WALL SECTIONS AND DETAILS
- A6.9 WALL SECTIONS
- A7.1 DOORS SCHEDULE AND DETAILS
- A7.2 WINDOW AND DOOR FRAME ELEVATIONS
- A7.3 HOLLOW METAL DOOR AND WINDOW DETAILS
- A7.4 ALUMINUM DOOR AND WINDOW DETAILS
- A7.5 ALUMINUM DOOR AND WINDOW DETAILS
- A7.6 ALUMINUM DOOR AND WINDOW DETAILS
- A8.1 ENLARGED PLANS AND RESTROOM PLANS
- A8.2 ENLARGED GYMNASIUM PLAN AND DETAILS
- A9.1 STAIR A PLANS AND DETAILS
- A9.2 STAIR B & C PLANS AND DETAILS
- A9.3 STAIR D, E & F PLANS AND DETAILS
- A9.4 RAMP PLAN, RAMP SECTION, AND RAILING DETAILS
- A9.5 STAIR DETAILS
- A9.6 ELEVATOR PLANS AND DETAILS
- A10.1 PLAN DETAILS
- A10.2 PLAN DETAILS
- A10.3 PLAN DETAILS
- A11.1 INTERIOR ELEVATIONS RESTROOMS
- A11.2 INTERIOR ELEVATIONS
- A11.3 INTERIOR ELEVATIONS
- A11.4 INTERIOR ELEVATIONS CLASSROOMS
- A11.5 INTERIOR ELEVATIONS GYMNASIUM
- A11.6 INTERIOR ELEVATIONS MEDIA CENTER
- A11.7 INTERIOR ELEVATIONS LOBBY AND COLLABORATION
- A11.8 INTERIOR ELEVATIONS CORRIDORS
- A11.9 INTERIOR ELEVATIONS CAFETERIA
- A12.1 CASEWORK SECTIONS
- A12.2 CASEWORK SECTIONS
- A13.1 WALKWAY CANOPY PLAN, SECTIONS AND DETAILS

INTERIOR DESIGN

- ID.1 FINISH NOTES AND LEGEND
- ID.2 FIRST FLOOR FINISH PLAN AREA A
- ID.3 FIRST FLOOR FINISH PLAN AREA B
- ID.4 SECOND FLOOR FINISH PLAN

STRUCTURAL

- S1.00 STRUCTURAL GENERAL NOTES
- S1.01 STRUCTURAL GENERAL NOTES
- S2.00 OVERALL FOUNDATION PLAN
- S2.10 FOUNDATION PLAN AREA A
- S2.11 FOUNDATION PLAN AREA B
- S2.20 FOUNDATION DETAILS
- S2.21 FOUNDATION DETAILS
- S2.22 FOUNDATION DETAILS
- S3.00 OVERALL 2ND FLOOR/LOW ROOF AND PLATFORM PLANS
- S3.10 SECOND FLOOR/LOW ROOF FRAMING PLAN AREA A
- S3.11 SECOND FLOOR/LOW ROOF FRAMING PLAN AREA B
- S3.12 MECHANICAL PLATFORM FLOOR FRAMING PLAN AREA A
- S3.13 GYMNASIUM PLATFORM FLOOR FRAMING PLAN AREA B

- S3.20 FLOOR FRAMING DETAILS
- S3.21 FLOOR FRAMING DETAILS
- S3.22 FLOOR FRAMING DETAILS
- S3.23 FLOOR FRAMING DETAILS
- S4.00 OVERALL HIGH ROOF/CLEARSTORY FRAMING PLAN
- S4.10 HIGH ROOF FRAMING PLAN AREA A
- S4.11 HIGH ROOF FRAMING PLAN AREA B
- S4.12 CLEARSTORY FRAMING PLAN
- S4.20 ROOF FRAMING DETAILS
- S4.21 ROOF FRAMING DETAILS
- S4.22 ROOF FRAMING DETAILS
- S4.23 ROOF FRAMING DETAILS
- S5.00 STRUCTURAL BUILDING SECTIONS
- S5.10 STRUCTURAL BUILDING SECTIONS AND ELEVATIONS

#### PLUMBING

- FP1.1 FIRST, SECOND FLOOR & MECH. PLATFORM FIRE PROTECTION PLANS
- FP1.2 ENLARGED FIRE PROTECTION PLAN AND NOTES
- P1.1 FOUNDATION PLUMBING PLAN AREA A
- P1.2 FOUNDATION PLUMBING PLAN AREA B
- P1.3 FIRST FLOOR PLUMBING PLAN AREA A
- P1.4 FIRST FLOOR PLUMBING PLAN AREA B
- P1.5 SECOND FLOOR PLUMBING PLAN
- P1.6 MECHANICAL PLATFORM AND ROOF PLUMBING PLANS
- P1.7 WATER BOTTLE FILLING STATION PLANS
- P2.1 PLUMBING DETAILS
- P3.1 PLUMBING SCHEDULES
- P4.1 SANITARY RISER DIAGRAM FIRST FLOOR AREA A
- P4.2 SANITARY RISER DIAGRAM AREA B
- P4.3 SANITARY RISER DIAGRAM SECOND FLOOR AREA A

#### MECHANICAL

- M1.1 FIRST FLOOR HVAC PLAN AREA A
- M1.2 FIRST FLOOR HVAC PLAN AREA B
- M1.3 SECOND FLOOR & MECH. PLATFORM HVAC PLAN AREA A (COMPOSITE)
- M1.4 SECOND FLOOR, MECH. PLATFORM HVAC PLAN AREA A (SUPPLY & RETURN)
- M1.5 SECOND FLOOR MECH. PLATFORM HVAC PLAN AREA A (OA & EXHAUST)
- M2.1 FIRST FLOOR HVAC PIPING PLANS AREA A
- M2.2 FIRST FLOOR HVAC PIPING PLANS AREA B
- M2.3 SECOND FLOOR & MECH. PLATFORM HVAC PIPING PLAN AREA A
- M3.1 ENLARGED HVAC PLANS MECHANICAL PLATFORM AREA B
- M3.2 ENLARGED OFFICE HVAC PLAN & HVAC SECTIONS
- M4.1 HVAC SCHEDULES
- M5.1 HVAC DETAILS
- M6.1 TEMPERATURE CONTROL DIAGRAMS & HVAC DETAILS
- M6.2 TEMPERATURE CONTROL/ FLOW DIAGRAMS
- U1.1 SITE UTILITY PLAN
- U1.2 SITE UTILITY DETAILS

#### ELECTRICAL

- E1.1 ELECTRICAL LEGEND
- E1.2 LIGHTING FIXTURE SCHEDULE
- E1.3 LIGHTING FIXTURE SCHEDULE(CONTINUED)
- E1.4 ELECTRICAL DETAILS

- E1.5 ELECTRICAL DETAILS(CONTINUED)
- E1.6 ELECTRICAL DETAILS(CONTINUED)
- E2.1a FIRST FLOOR POWER PLAN AREA A
- E2.1b FIRST FLOOR POWER PLAN AREA B
- E2.2 SECOND FLOOR POWER PLAN
- E2.3 ENLARGED KITCHEN POWER PLAN
- E2.4 MECHANICAL EQUIPMENT POWER & SYSTEMS PLAN
- E3.1a FIRST FLOOR SYSTEMS AND TECHNOLOGY PLAN AREA A
- E3.1b FIRST FLOOR SYSTEMS AND TECHNOLOGY PLAN AREA B
- E3.2 SECOND FLOOR SYSTEMS AND TECHNOLOGY PLAN AREA A
- E3.3 FIRST FLOOR CABLE TRAY PLAN
- E3.4 SECOND FLOOR CABLE TRAY PLAN
- E4.1a FIRST FLOOR LIGHTING PLAN AREA A
- E4.1b FIRST FLOOR LIGHTING PLAN AREA B
- E4.2a SECOND FLOOR LIGHTING PLAN AREA A
- E4.2b SECOND FLOOR LIGHTING PLAN AREA B
- E5.1 ONE-LINE DIAGRAMS
- E6.1 BUSSING DIAGRAMS
- E6.2 BUSSING DIAGRAMS(CONTINUED)
- E7.1 ELECTRICAL SITE PLAN AREA A
- E7.2 ELECTRICAL SITE PLAN AREA B
- E7.3 SITE DETAILS

**KITCHEN** 

- K1.1 EQUIPMENT PLAN
- K1.2 UTILITY SCHEDULES
- K2.1 ELECTRICAL ROUGH-IN PLAN
- K3.1 PLUMBING ROUGH-IN PLAN
- K4.1 SPECIAL CONDITIONS PLAN
- K5.1 UDS
- K6.1 WALK-IN
- K6.2 WALK-IN
- K6.3 WALK-IN
- K7.1 HOOD
- K7.2 HOOD

072500 WEATHER BARRIERS	3
072726 FLUID-APPLIED MEMBRANE AIR BARRIERS	6
074100 STANDING SEAM METAL ROOFING	-
074213.13. METAL WALL PANELS	9
074293.53 METAL SOFFIT PANELS	9
075250 MODIFIED BITUMINOUS MEMBRANE ROOFING (under roof patio)	5
076200 SHEET METAL FLASHING AND TRIM	9
077100 ROOF SPECIALTIES	5
077200 ROOF ACCESSORIES	5
077616 ROOF DECKING PAVERS	5
078413 PENETRATION FIRESTOPPING	5
078446 FIRE-RESISTIVE JOINT SYSTEMS	5
079200 JOINT SEALANTS	5
079500 EXPANSION CONTROL	5
DIVISION 08 – OPENINGS	
081113 HOLLOW METAL DOORS AND FRAMES	9
081416 FLUSH WOOD DOORS	5
083113 ACCESS DOORS AND FRAMES	3
083300 TORNADO COILING DOORS	
083313 COILING COINTER DOORS	5
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS	8
084413 GLAZED ALUMINUM CURTAIN WALLS	5
087100 DOOR HARDWARE	49
088000 GLAZING	9
089000 LOUVERS AND VENTS	2
DIVISION 09 – FINISHES	
090561.13. MOISTURE VAPOR EMISSION CONTROL	6
092116 SHAFT WALL ASSEMBLIES	_
092216 NON-STRUCTURAL METAL FRAMING	6
092900 GYPSUM BOARD	7
093013 CERAMIC TILING	11
095000 ACOUSTICAL WOOD CEILINGS	7
095113 ACOUSTICAL PANEL CEILINGS	7
096466 WOOD ATHLETIC FLOORING	6
096513 RESILIENT BASE AND ACCESSORIES	5
096543 LINOLEUM FLOORING	5
096813 TILE CARPETING	6
096816 SHEET CARPETING	5
097723 FABRIC WRAPPED PANELS	5
098433 SOUND ABSORBING WALL UNITS	5
098436 SOUND ABSORBING CEILING UNITS	5
099113 EXTERIOR PAINTING	5
099123 INTERIOR PAINTING	8

**DIVISION 10 – SPECIALTIES** 

101100 VISUAL DISPLAY UNITS	
101423 PANEL SIGNAGE	
102113.17 PHENOLIC-CORE TOILET CO	MPARTMENTS
102123 CUBICLE CURTAINS AND TRA	ACKS
102239 FOLDING PANEL PARTITIONS	5
102600 WALL AND DOOR PROTECTION	ON
102800 TOILET, BATH AND LAUNDRY	ACCESSORIES
104413 FIRE EXTINGUISHER CABINE	TS
104416 FIRE EXTINGUISHERS	
105113 METAL LOCKERS	
105300 PRE-ENGINEERED ALUMINUI	M WALKWAYS
107113 ALUMINUM CANOPYS	
107516 GROUND-SET FLAGPOLES	
1161/3 STAGE CURTAINS	
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
DIVISION 12 – FURNISHINGS	
122413 ROLLER WINDOW SHADES	
123623.13 PLASTIC LAMINATE CLAD CC	OUNTERTOPS
123661 SIMULATED STONE COUNTE	RTOPS
124813 ENTRANCE FLOOR MATS AN	D FRAMES
126600 TELESCOPING STANDS	
129300 SITE FURNISHINGS	
142400 MACHINE ROOM-LESS III DR	AULIC ELEVATORS
DIVISION 20 - GEOTHERMAL	
201305 GEOTHERMAL LOOP SYSTEM	И
201310 PIPE FILLING, CLEANING, FLU	JSHING, PURGING AND CHEMICAL TREATMENT
210548 VIBRATION AND SEISMIC CO EQUIPMENT	NTROLS FOR FIRE SUPPRESSION PIPING AND
211313 WATER BASESD FIRE-SUPPR	RESSION SYSTEMS
	FMS
213113 ELECTRIC-DRIVE, CENTRIFU	
DIVISION 22 – PLUMBING	
220500 COMMON WORK RESULTS FO	OR PLUMBING
220519 METERS AND GAUGES FOR F	PLUMBING PIPING

220523 GENERAL-DUTY VALVES FOR PLUMBING PIPING	5
220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT	9
220548 VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT	5
220553 IDENTIFICATION FOR PIPING AND EQUIPMENT	5
220700 PLUMBING INSULATION	10
220800 COMMISSIONING FOR PLUMBING SYSTEMS	4
221116 DOMESTIC WATER PIPING	9
221119 DOMESTIC WATER PIPING SPECIAL TIES	5
221123 DOMESTIC WATER PLIMPS	5
221123 13 DOMESTIC WATER BOOSTER PUMPS	7
221316 SANITARY WASE AND VENT PIPING	. 6
221310 SANITARY WASTE PIPING SPECIAL TIES	3
	6
	2
	2
223400 PULIMPING FIVELIDES	1
	9
224700 DRINKING FOUNTAINS AND WATER BUTTLE FILLING STATIONS	3
	•
230500 COMMON WORK RESULTS FOR PLUMBING	9
230513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT	3
230519 METERS AND GAUGES FOR HVAC PIPING	4
230523 GENERAL DUTY VALVES FOR HVAC PIPING	6
230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT	11
230548 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT	7
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT	3
230593 TESTING, ADJUSTING AND BALANCING FOR HVAC	16
230700 HVAC INSULATION	14
230716 HVAC EQUIPMENT INSULATION	6
230800 COMMISSIONING FOR HVAC SYSTEMS	5
230900 BUILDING AUTOMATION SYSTEM	23
231123 FACILITY NATURAL GAS PIPING	15
232113 HYDRONIC PIPING	12
232113.33 GROUND LOOPP HEAT PUMP PIPING	6
232123 HYDRONIC PUMPS	6
232300 REFRIGERANT PIPING	6
232500 HVAC WATER TREATMENT	5
233113 METAL DUCTS	11
233300 AIR DUCT ACCESSORIES	7
233400 HIGH VOLUME. LOW SPEED HVAC FANS	4
233423 HVAC POWER VENTILATORS	4
233600 AIR TERMINAL UNITS	6
233713 DIFFUSERS REGISTERS AND GRILLES	2
233716 FABRIC AIR DISTRIBUTION DEVICES	3
237413 PACKAGED DEHLIMIDIFICATION AIR HANDLING LINITS	a
238126 SPI IT SYSTEM AIR CONDITIONERS	6 6
238146 WATER SOURCE UNITARY HEAT DUMPS	7
	'

238239.19 WALL AND CEILING UNIT HEATERS
DIVISION 26 – ELECTRICAL
260500 COMMON WORK RESULTS FOR ELECTRICAL
260519 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260543 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923 LIGHTING CONTROL DEVICES
262200 LOW-VOLTAGE TRANSFORMERS
262413 SWITCHBOARDS
262416 PANELBOARDS
262726 WIRING DEVICES
262813 FUSES (600V AND LESS)
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
262913 ENCLOSED CONTROLLERS
265100 INTERIOR LIGHTING
265600 EXTERIOR LIGHITNG
DIVISION 27 – COMMUNICATIONS
270500 COMMON WORK RESULTS FOR COMMUNICATIONS
271310 STRUCTURED VOICE & DATA CABLING SYSTEMS
DIVISION 28 – ELECTRONIC SAFETY AND SECURITY
280500 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
283111 DIGITAL ADDRESSABLE FIRE ALARM SYSTEMS
DIVISION 31 – EARTHWORK
311000 SITE CLEARING
312000 EARTH MOVING
DIVISION 32 – EXTERIOR IMPROVEMENTS
321216 ASPHALT PAVING
321313 CONCRETE PAVING
321373 CONCRETE PAVING JOINT SEALANTS
321400 UNIT PAVING
323113 CHAIN LINK FENCES AND GATES
329113 SOIL PREPARATION
329200 TURE AND GRASSES
320300 PLANTS
DIVISION 33 – EXTERIOR IMPROVEMENTS
330500 COMMON WORK RESULTING FROM UTILITIES
334100 STORM UTILITY DRAINAGE PIPING
334600 SUBDRAINAGE

Jefferson Elementary School Henderson County Schools Henderson, KY

END OF TABLE OF CONTENTS

SECTION 012300 - ALTERNATES

#### 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 administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

#### 3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: State the amount to be added to the Base Bid to provide a Gym Separation Curtain as indicated on the drawings.
- B. Alternate No. 2: State the amount to be deducted from the Base Bid to remove gym board bulkheads from cafeteria ceiling as indicated on Alternate RCP plan.
- C. Alternate No. 3: State the amount to be deducted from the Base Bid to provide a two post canopy section along drop of lane as indicated on drawings in lieu of the cantilevered section.
- D. Alternate No. 4: State the amount to be deducted from the Base Bid to delete construction of parking lot on Alves Street from project as indicated on plans.
- E. Alternate No. 5: State the amount to be deducted from the Base Bid to delete the Basketball and Foursquare courts from project as indicated on plans. Alternate will include seeding and grading of area indicated.
- F. Alternate No. 6 Reserved.

END OF SECTION 012300

SECTION 042000 - UNIT MASONRY

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 unit masonry assemblies consisting of the following:
  - 1. Concrete masonry units (CMUs).
  - 2. Decorative concrete masonry units.
  - 3. Face brick.
  - 4. Stone Trim Units
  - 5. Mortar and grout.
  - 6. Reinforcing steel.
  - 7. Masonry joint reinforcement.
  - 8. Ties and anchors.
  - 9. Embedded flashing.
  - 10. Miscellaneous masonry accessories.
  - 11. Cavity drainage material.
  - 12. Cavity wall insulation.
- B. Related Sections include the following:
  - 1. Division 01 Section "Allowances".
  - 2. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.
- C. Products installed, but not furnished, under this Section include the following:
  - 1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications."
- 1.3 DEFINITIONS
  - A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

#### 1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

#### 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing service: Engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
  - 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
  - Mortar Test (Property Specification): For each mix required, according to ASTSM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  - 3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
  - 2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
- C. Samples for Selection:
  - 1. Face Brick.
  - 2. Limestone trim.
  - 3. Decorative masonry units (small scale units).
  - 4. Mortar samples
- D. Samples for Verification: For each type and color of the following:
  - 1. Face brick, in the form of straps of five or more bricks.
  - 2. Stone Masonry
  - 3. Decorative concrete masonry units.
  - 4. Weep holes/vents.
  - 5. Accessories embedded in masonry.
  - 6. Mortar Samples
- E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
  - 1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.

- c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
- d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
- 2. Cementitious materials. Include brand, type, and name of manufacturer.
- 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
- 4. Grout mixes. Include description of type and proportions of ingredients.
- 5. Reinforcing bars.
- 6. Joint reinforcement.
- 7. Anchors, ties, and metal accessories.
- F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
  - 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- G. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1 / ASCE 6/TMS 602.

#### 1.7 QUALITY ASSURANCE

- A. Testing Agency Requirements: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 60 inches (1500 mm) high by full thickness, including face and backup withes and accessories.
    - a. Include a stone trim unit.
    - b. Include a sealant-filled joint at least 16 inches (400mm) long in mockup.

- c. Include through-wall flashing installed for a 24-inch (600 mm) length in corner of mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300 mm) length of flashing left exposed to view (omit stone masonry above half of flashing).
- 2. Protect accepted mockups from the elements with weather resistant membrane.
- 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."
- G. Testing agency qualifications.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

#### 1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
  - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.

#### 2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

#### 2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide bullnose units for outside corners, unless otherwise indicated.
- B. Concrete Masonry Units: ASTM C 90:
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
  - 2. Weight Classification: Normal weight, unless otherwise indicated.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
  - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
- C. Decorative CMUs: ASTM 90:
  - 1. Basis of Design: "Trendstone" as manufactured by Trenwyth an Old Castle Company or approved product manufactured by:
    - a. Kingston Block and Masonry Supply.
    - b. New Hollard Concrete.
    - c. E.P. Henry Corporation.
  - 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
  - 3. Density Classification: Normal weight.
  - 4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
  - 5. Pattern and Texture:
    - a. Standard pattern, ground-face finish.
  - 6. Colors: As selected by Architect from manufacturer's full range.

## 2.4 BRICK

- A. General: Provide shapes indicated and as follows:
  - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
  - 3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C 216.
  - 1. Grade: SW.
  - 2. Type: FBX
  - 3. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 11-5/8 long (utility-size).
  - 4. Application: Use where brick is exposed unless otherwise indicated.

### 2.5 STONE TRIM UNITS

- A. Limestone: ASTM C 568, Classification II Medium-Density.
  - 1. Variety and Sources: Indiana oolitic limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.

- a. Grade and Color: Buff.
- B. Finish: Smooth.
- C. Provide stone units accurately shaped, with exposed faces dressed true, and with beds and joints at right angles to faces.
  - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook.

## 2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Mortar Cement: ASTM C 1329.
  - 1. Available Products:
    - a. Lafarge North America, Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.
- E. Water: Potable.
- F. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone of color necessary to match existing mortar color.
  - 2. For joints less than <sup>1</sup>/<sub>4</sub> inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.
- G. Aggregate for Grout: ASTM C 404.

### 2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951.
  - 1. Interior Walls: Mill-galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:

- 1. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8 inch (16-mm) cover on outside face.
- 2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8 inch (16-mm) cover on outside face.

### 2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
  - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
  - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
  - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.
  - 2. Where wythes do not align, use adjustable ties with pintle-and eye connections having a maximum adjustment of 1-1/14 inches (32 mm).
  - 3. Wire: Fabricate from 3/16 inch (4.76 mm) diameter, hot-dip galvanized steel wire. Millgalvanized wire ties may be used in interior walls unless otherwise indicated.

## 2.9 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM F1554, with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

### 2.10 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
  - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.

- 2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
- 3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
- 4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
- 5. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
- B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:
  - 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.0 mm). a. Products:
    - 1) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru Wall Flashing.
    - 2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier-44.
    - 3) Grace Construction Products, a unit of WR Grace & Co. Conn; Perm-A-Barrier Wall Flashing.
    - 4) Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
    - 5) Hohmann & Barnard, Inc.; Textroflash.
    - 6) W.R. Meadows, Inc.: Air-Shield Thru Wall Flashing.
    - 7) Williams Products, Inc.' Everlastic MF-40.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

### 2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following, unless otherwise indicated:
  - 1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8 inch (9-mm) OD by 4 inches (100 mm) long.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

- 1. Products:
  - a. Advanced Building Products, Inc.; Mortar Break, Mortar Break II.
  - b. Achovations, Inc..; CavClear Masonry Mat.
  - c. Dayton Superior Corporation, Dur-O-Wal Division, Polytite MortarStop.
  - d. Mortar Net USA Ltd.; Mortar Net.
- 2. Provide one of the following configurations:
  - a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

## 2.12 CAVITY WALL INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.
  - 1. 3" Thickness, unless noted otherwise.
- B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

#### 2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

### 2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
  - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
  - 4. For reinforced masonry, use Portland cement-lime mortar.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

- 1. For masonry below grade or in contact with earth, use Type S.
- 2. For reinforced masonry, use Type S.
- 3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- 4.
- a. For exposed brick veneer: Brixment, Specmix or Equivalent -Color TBD.
- b. Provide different colors for each brick type.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
  - 2. Proportion grout in accordance with ASTM C 476, Table 1.
  - 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

### 2.15 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
  - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook".
- B. Cut or split stone to produce pieces of thickness, size and shape indicated, including details on Drawings.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors and supports.
- E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material and fabrication. Replace defective units before shipment.
   1. Clean sawed backs of stone to remove rust stains and iron particles.
- F. Thickness of Stone: Provide thickness indicated, but not less than the following:
  1. Thickness: 4 inches (100 mm) plus or minus ¼ inch (6 mm).
- G. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.
  - 1. Finish for Sills: Smooth.
  - 2. Finish for Lintels: Smooth.
  - 3. Finish for Trim: Smooth.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  - 2. Verify that foundations are within tolerances specified.
  - 3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains and foreign materials before setting. 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 material or abrasives.

#### 3.3 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
  - 1. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

- 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
- 3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
- 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
- 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
- 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
- 7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

# 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- A. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- B. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
  - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  - 2. Allow cleaned surfaces to dry before setting.
  - 3. Wet joint surfaces thoroughly before applying mortar
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

- F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
  - 1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide ½ inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200mm) o.c. unless otherwise indicated.
  - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
  - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  - 2. Allow cleaned surfaces to dry before setting.
  - 3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

### 3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
  - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where bed joints of both wythes align and are of the same material, use laddertype reinforcement extending across both wythes.
    - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement.
- B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
  - 1. Provide continuity with masonry joint reinforcement at corners by using prefabricated Lshaped units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
  - 1. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.

#### 3.7 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
  - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
    - a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions to cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Apply air barrier to face of backup wythe to comply with Section 072726 "Fluid Applied Membrane Air Barriers".
- D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
  - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

### 3.8 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
  - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
  - 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

- 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
  - a. Reinforcement above is in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

### 3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for inplane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Install preformed control-joint gaskets designed to fit standard sash block.
  - 2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
  - 3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick made from clay or shale as follows:
  - 1. Build in compressible joint fillers where indicated.
  - Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch (10 mm).
  - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

### 3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

- B. Install flashing as follows, unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. At multiwythe masonry walls, uncluding cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe..
  - 3. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
  - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing ½ inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
  - 1. Use specified weep/vent products to form weep holes in brick veneer.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

### 3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Testing Prior to Construction: One set of tests.
- C. Testing Frequency: One set of tests for each 5,000 sq. ft. (464 sq. m) of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780,. Test mortar for mortar air content and compressive strength.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

### 3.14 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

- 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
- 8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."
- 3.15 MASONRY WASTE DISPOSAL
  - A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION 042000

SECTION 054000 - COLD-FORMED 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. This Section includes the following:
  - 1. Exterior non-load-bearing wall framing.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for steel lintels.
  - 2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metalstud framing and ceiling-suspension assemblies.
  - 3. Division 06 Section "Sheathing" for wall sheathing.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
  - 1. Design Loads: As indicated.
  - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
  - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
  - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 1 inch (25 mm).
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing General Provisions."

- 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing Header Design."
- 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

## 1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
  - 1. Steel sheet.
  - 2. Expansion anchors.
  - 3. Power-actuated anchors.
  - 4. Mechanical fasteners.
  - 5. Vertical deflection clips.
  - 6. Horizontal drift deflection clips
  - 7. Miscellaneous structural clips and accessories.
- F. Research/Evaluation Reports: For cold-formed metal framing.

### 1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. 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 cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

- D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing General Provisions."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
  - 1. Clark Steel Framing.
  - 2. Craco Metals Manufacturing, LLC.
  - 3. Dale/Incor.
  - 4. Dietrich Metal Framing; a Worthington Industries Company.
  - 5. MarinoWare; a division of Ware Industries.

## 2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G90 (Z275) or equivalent.
- B. Steel Sheet for Vertical Deflection, Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G90 (Z275).

# 2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
  - 2. Flange Width: 1-5/8 inches (41 mm) minimum.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel studs.

### 2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Gusset plates.
  - 7. Stud kickers, knee braces, and girts.

### 2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

### 2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

# 2.7 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
  - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing -General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

## 3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: 16 inches (406 mm), As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single-leg deflection tracks and anchor to building structure.
  - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  - 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
  - 4. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
  - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    - a. Install solid blocking at centers indicated on Shop Drawings.
  - 2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

### 3.4 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055100 - METAL STAIRS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Steel stairs with concrete-filled treads.
  - 2. Steel tube handrails attached to walls adjacent to metal stairs.
  - 3. Integral hand and guardrails.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
  - 2. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.
- B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
  - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:

- a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
- b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.
- 3. Infill of Guards:
  - a. Concentrated load of 200 lbf (0.89 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
  - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures" : Section 9, "Earthquake Loads."

### 1.4 SUBMITTALS

- A. Shop Drawings: Stamped and signed shop drawings from engineer registered in state of Kentucky. Include plans, elevations, sections, details, and attachments to other work.
- B. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  - 1. Steel Stairs: Commercial class.
- C. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

## 1.6 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

# PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

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

### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- C. Iron Castings: Either gray or malleable iron, unless otherwise indicated.
  - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
  - 2. Malleable Iron: ASTM A 47/A 47M.
- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

#### 2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
  - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.
- E. Welded Wire Fabric: ASTM A 185, 6 by 6 inches (152 by 152 mm)--W1.4 by W1.4, unless otherwise indicated.

### 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts,[railings,] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding, unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously, unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

# 2.6 STEEL-FRAMED STAIRS

A. Stair Framing:

- 1. Fabricate stringers of steel channels or tubes as indicated.
  - a. Provide closures for exposed ends of channel, tube stringers.
- 2. Construct platforms of steel channels or tubes and miscellaneous framing members as indicated.
- 3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
- 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
- B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch (1.7 mm), indicated.
  - 1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
  - 2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
  - 3. Shape metal pans to include nosing integral with riser.
  - 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

### 2.7 STEEL TUBE RAILINGS

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
  - 1. Rails: 1-5/8-inch- (41-mm-) diameter.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Form changes in direction of railings as follows:1. By bending or by inserting prefabricated elbow fittings.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

## 2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
  - 1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:

- 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- 2. Obtain fusion without undercut or overlap.
- 3. Remove welding flux immediately.
- 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Castin-Place Concrete."

## 3.2 INSTALLING STEEL TUBE RAILINGS

- A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 3. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

## 3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Steel pipe and tube railings.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
  - 2. Fittings and brackets.
- E. Welding certificates.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.6 / D1.2M, "Structural Welding Code—Stainless Steel."

#### 1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

- 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
- 2. Provide allowance for trimming and fitting at site.

### 1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.7 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage qualified professional engineer, as defined in Section 014000 "Quality Requirements", to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.

### PART 2 - PRODUCTS

## 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

## 2.2 STEEL AND IRON

- A. Pipe: ASTM A 53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- B. Plates, Shapes, and Bars: ASTM A36/A 36M.
- C. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

### 2.3 FASTENERS

- A. General: Provide the following:
  - 1. Ungalvanized Steel Railings: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 5 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

### 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
  - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

### 2.5 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as follows:
  - 1. By bending.
- J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
- M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- 2.6 FINISHES, GENERAL
  - A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

### 2.7 STEEL AND IRON FINISHES

- A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
  - 1. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  - 1. Shop prime uncoated railings with primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" unless zinc-rich primer is indicated.

# PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

#### 3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

### 3.3 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of cable material post, attached to post with set screws.

#### 3.4 ADJUSTING AND CLEANING

- A. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA requirements for touching-up shop painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0 mil (0-.05 mm) dry film thickness.

### 3.5 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 055813 - COLUMN COVERS

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 snap-together metal column covers.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for column covers.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- square Samples of metal of same thickness and material indicated for the Work.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator organic-coating applicator anodic finisher and powder-coating applicator.

### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing column covers similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Manufacturer shall have a minimum of 5 years experience in manufacturing architectural metals.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver column covers wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

# PART 2 - PRODUCTS

### 2.1 SNAP-TOGETHER COLUMN COVERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. ATAS International, Inc.
  - 2. Fry Reglet Corporation.
  - 3. <u>MM Systems Corporation.</u>
  - 4. <u>Moz Designs, Inc.</u>
  - 5. <u>Pittcon Industries.</u>
  - 6. SAF.
  - 7. Sobotec.
- B. Form column covers to shapes indicated from metal of type and minimum thickness indicated below. Return vertical edges and bend to form hook that engages continuous mounting clips.
  - 1. Aluminum Sheet: ASTM B 209, with not less than strength and durability properties of Alloy 5005-H32, 0.063 inch 0 thick.
    - a. Finish: High-performance organic coating.
  - 2. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
  - 3. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide flat surfaces where indicated.
  - 4. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
  - 5. Form returns at vertical joints to provide hairline V-joints.
  - 6. Fabricate column covers with hairline horizontal V-joints produced by forming returns on mating ends of column cover sections. Locate horizontal joints as indicated.
  - 7. Fabricate base and ceiling ring to match column covers.
  - 8. Fabricate with calk stop/stiffener ring.

### 2.2 MISCELLANEOUS MATERIALS

- A. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
  - 1. Provide concealed fasteners for interconnecting column covers and for attaching them to other work unless otherwise indicated.
- B. Backing Materials: Provided or recommended by column cover manufacturer.

## 2.3 PAINTS AND COATINGS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
# 2.4 FABRICATION, GENERAL

- A. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- B. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends.

#### 2.5 GENERAL FINISH REQUIREMENTS

- A. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### 2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent 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.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of column covers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Locate and place column covers plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install column covers.
  - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible.

- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

# 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean abraded areas of shop paint and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

## 3.4 PROTECTION

A. Protect finishes from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 055813

# SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

#### 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. Pre-engineered, component based, ornamental glazed decorative metal railings as set forth by this document and as detailed in construction documents.

#### 1.3 ADDITIONAL WORK INCLUDED IN THIS SECTION

- A. Reinforcing for wall rail brackets at dry wall partitions supplied and installed by General Contractor.
- B. Field measuring for weld plates, sleeves and insert locations by railing installer.
- C. Field measuring by railing installer.

#### 1.4 DESIGN REQUIREMENTS

- A. Railing system shall be designed to conform to the Indiana Building Code and ADA requirements for openings and stress.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Stainless steel: 60 percent of minimum yield strength.
  - 2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass".
- C. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of 50 lbf/ft. (0.73 Kn/M) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 Kn) APPLIED IN ANY DIRECTION.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 ldf (0.89 kN) applied in any direction.

- c. Uniform and concentrated loads need not be assumed to act concurrently.
- 3. Infill of Guards:
  - a. Concentrated load of 200 lbf (0.89 nK) applied horizontally on an area of 1 sq. ft. (0.93 sq. m).
  - b. Infill load and other loads need not be assumed to act concurrently.

#### 1.5 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

## 1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

## 1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

#### 1.8 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of railings assembled from standard components.
  - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
- C. Samples for Verification: For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
  - 2. Each type of glass required.
  - 3. Fittings and brackets.
  - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.9 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

## 1.10 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Button Rail as manufactured and assembled by Livers Bronze or comparable product by one of the following:
  - 1. RB Wagner, Inc.
  - 2. M3 Glass Technologies
  - 3. C.R. Laurence Co, Inc.
  - 4. Viva Railings
  - 5. Trex Commercial Products
  - 6. Novum Structures, LLC
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, accessories, hardware, brackets, fittings, mounting and dimensional requirements of railings and are based on the specific systems indicated. See Section 016000 "Product Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Steel: 72 percent of minimum yield strength.
- 2.3 METALS, GENERAL
  - A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
  - B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

#### 2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of allow and temper designated below.

- B. Extruded Bars and Shape: ASTM B 221 (ASTM B 221M, Alloy 6063-T5/T52.
- C. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
- D. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.
- E. Base: 2-1/2" x 4" extruded aluminum with pocket sized to accommodate glass thickness.

## 2.5 GLASS AND GLAZING MATERIALS

- A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.
- B. Fully tempered-kind FT, quality Q3, ASTM C 1048 conditions A, Type 1, transparent glass.
  - 1. Glass Color: Clear
  - 2. Thickness: 3/8-inch
- C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
  - 1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

# 2.6 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Railings: Type 302 stainless-steel fasteners.
  - 2. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

# 2.7 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

#### 2.8 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- F. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- G. Form changes in direction as follows:
  - 1. By flush bends or by inserting prefabricated flush-elbow fittings.
- H. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- I. Close exposed ends of hollow railing members with prefabricated end fittings.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
  - 1. Refer to details on drawings for products and manufacturers.

## 2.9 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
  - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
  - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Balusters: Provide laminated, tempered glass panels.

## 2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal finishes Manual for Architectural 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 shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within onehalf of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

# 2.11 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

#### PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Fit exposed connections together to form tight, hairline joints.
  - B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
    - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
    - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
    - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
  - C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
  - E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

#### 3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

## 3.3 INSTALLING GLASS PANELS

A. Post-Supported Glass Railings: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

## 3.4 CLEANING

- A. Clean aluminum by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

# 3.5 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057313

# 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. This Section includes the following:
  - 1. Wood blocking, cants, and nailers.
  - 2. Wood sleepers.
  - 3. Plywood backing panels.
- B. Related Sections include the following:
  - 1. Division 06 Section "Sheathing."
  - 2. Division 06 Section "Interior Architectural Woodwork" for nonstructural carpentry items exposed to view and not specified in another Section.

#### 1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NHLA: National Hardwood Lumber Association.
  - 3. NLGA: National Lumber Grades Authority.
  - 4. SPIB: The Southern Pine Inspection Bureau.
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPA: Western Wood Products Association.

#### 1.4 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

- 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Expansion anchors.

## 1.5 QUALITY ASSURANCE

- A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":
  - 1. Dimension lumber framing.
  - 2. Miscellaneous lumber.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
  - B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

# 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.
  - 2. Provide dressed lumber, S4S, unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
  - 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. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and the following:
  - 1. Plywood backing panels.
  - 2. Concealed blocking.
  - 3. Wood cants, nailers, curbs within 4 feet of fire-rated assemblies.

## 2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 15 percent.
- B. Miscellaneous Framing: Construction or No. 2 grade and any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Southern pine; SPIB.
  - 3. Douglas fir-larch; WCLIB or WWPA.
  - 4. Spruce-pine-fir; NLGA.
  - 5. Douglas fir-south; WWPA.
  - 6. Hem-fir; WCLIB or WWPA.
  - 7. Douglas fir-larch (north); NLGA.
  - 8. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

## 2.5 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. Furring.

- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content 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.

# 2.6 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

# 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

# PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. Sort and select lumber so that natural characteristics will 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.
- F. 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.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- H. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

# 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- 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.

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. This Section includes the following:
  - 1. Wall sheathing.
  - 2. Roof sheathing.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for plywood backing panels.

#### 1.3 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 plywood complies 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.
  - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
  - 4. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Preservative-treated plywood.
  - 2. Building wrap.

## 1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

SHEATHING

# 2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
- B. Oriented Strand Board: DOC PS 2.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

# 2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA C9.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

# 2.3 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: Not less than 1/2 inch (13 mm).
- B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
  - 1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corporation or "e<sup>2</sup>XP" Extended Exposure Sheathing by National Gypsum Co.
  - 2. Type and Thickness: Regular,  $\frac{1}{2}$  inch (13 mm).

# 2.4 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: Not less than 5/8 inch.
- B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: Not less than 5/8 inch.

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
  - 1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

#### 2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing, and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
- B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Shelf-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 12 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

#### 2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01, ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

# 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.
  - 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. NES NER-272 for power-driven fasteners.
- 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof 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.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. 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 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
    - d. Do not apply concentrated loads between supports.

## 3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to wood framing with nails or screws.
  - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - Install panels with a 3/8 inch (9.5 mm) gap where non-load-bearing construction abuts structural elements.
    Install panels with a ¼ inch (6.4 mm) 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 center 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 (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
  - 2. For sheathing under stucco cladding, panels may be initially6 tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

- 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 (200 mm) o.c. and set back a minimum 3/8 inch (9.5 mm) from edges and ends of panels.
  - 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions:
  - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

# SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

## 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. Plastic-laminate-faced architectural cabinets.
  - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
- B. Related Requirements:
  - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

## 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate and cabinet hardware and accessories.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- C. Samples for Initial Selection:
  - 1. Plastic laminates.

- 2. PVC edge material.
- 3. Thermoset decorative panels.

# 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

#### 1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful inservice performance.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

## 1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

## PART 2 - PRODUCTS

# 2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fehrenbacher Cabinets (812) 963-3377.
  - 2. Counter Design (812) 477-1243.

- 3. Euronique (812) 983-3337.
- 4. Wilson Kitchens (618) 253-7449.

# 2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Premium.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. Reveal Dimension: 1/2 inch (13 mm) As indicated.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- G. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS.
  - 2. Vertical Surfaces: Grade HGS.
  - 3. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
  - 4. Pattern Direction: As indicated on the drawings.
- H. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
    - a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
    - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
  - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
  - 3. Drawer Bottoms: Thermoset decorative panels.
- I. Concealed Backs of Panels with Exposed or Semi-Exposed Plastic-Laminate Surfaces: Highpressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated on the Drawings/Interior Specifications.

# 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 [4 to 9] percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

#### 2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Wire Pulls:1. Back mounted, solid metal, 4 inches long, 5/16 inch diameter.
- D. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- E. Drawer Slides: BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; type; epoxy-coated steel with polymer rollers.
  - 2. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2.
  - 3. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
- F. Door and Drawer Silencers: BHMA A156.16, L03011.
- G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 630.
- H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.6 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

## 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

# 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 066400 - PLASTIC PANELING

#### 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 glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For plastic paneling and trim accessories.
- C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
  - 3. Testing Agency: FM Approvals, UL.

#### 1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

# PART 2 - PRODUCTS

#### 2.1 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Marlite.
  - 2. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
  - 3. Surface Finish: As indicated on Drawings and Interior Specifications.
  - 4. Color: As indicated on Drawings and Inerior Specifications.

#### 2.2 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Adhesive: As recommended by plastic paneling manufacturer.
  - 1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Sealant: Single-component, mildew-resistant, silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."
  - 1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, 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 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

- B. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches (300 mm) wide.
  - 1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
  - 2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

# 3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Start bottom of panels at top of base.
- E. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

# SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Modified bituminous sheet waterproofing.
- B. Related Sections include the following:
  - 1. Division 07 Section "Thermal Insulation " for insulation materials and installation.

#### 1.3 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- D. Qualification Data: For Installer.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- F. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials, molded-sheet drainage panels through one source from a single manufacturer.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## 1.7 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
  - 1. Failure includes, but is not limited to, failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
  - 2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

- 1. Products: Subject to compliance with requirements, provide one of the following:
  - a. American Hydrotech, Inc.; VM 75.
  - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
  - c. Grace, W. R. & Co.; Bituthene 3000, 4000.
  - d. Meadows, W. R., Inc.; SealTight Mel-Rol.
  - e. Pecora Corporation; Duramem 700-SM.
  - f. Polyguard Products; Polyguard 650.
- 2. Physical Properties:
  - a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
  - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
  - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
  - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
  - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
  - f. Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
  - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
  - h. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

# 2.2 MOLDED-SHEET DRAINAGE PANELS

A. Non-woven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, non-biodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. (112 to 261 L/min. per m).

# 2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

- F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
  - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
  - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
  - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:

- a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

# 3.3 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
  - 1. For vertical applications, install board insulation before installing drainage panels.

## 3.4 MODIFIED BITUMINOUS SHEET WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
- D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
- F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
  - 1. Board insulation may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.
- G. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

# 3.5 FIELD QUALITY CONTROL

A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

## 3.6 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Foam-plastic board insulation.
  - 2. Glass-fiber blanket insulation.
  - 3. Loose-fill insulation.
- B. Related Sections:
  - 1. Division 07 Section "TPO Roofing" for insulation specified as part of roofing construction.
  - 2. Division 07 Section "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.
  - 3. Division 07 Section "Exterior Insulation and Finish Systems" for insulation installed as part of the EIFS.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

#### 1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:

- 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
- 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
- 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

# PART 2 - PRODUCTS

# 2.1 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company (The).
    - c. Owens Corning.
    - d. Pactiv Building Products.
  - 2. Type IV, 25 psi (173 kPa).

## 2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. CertainTeed Corporation.
  - 2. Guardian Building Products, Inc.
  - 3. Johns Manville.
  - 4. Knauf Insulation.
  - 5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

# 2.3 LOOSE-FILL INSULATION

A. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application or Type II for poured application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
# PART 3 - EXECUTION

#### 3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

#### 3.3 INSTALLATION OF BELOW-GRADE PERIMETER WALL INSULATION

- A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

#### 3.4 INSTALLATION OF CAVITY-WALL CONTINUOUS INSULATION

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

#### 3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:

- 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
- 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
  - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

# 3.6 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

# 3.7 INSULATION SCHEDULE

- A. Below grade perimeter wall Insulation Type: Type IV extruded-polystyrene board insulation.
- B. Cavity Wall Continuous Insulation Type: Type IV extruded-polystyrene board insulation.
- C. Building Wall Insulation Type: Unfaced, glass-fiber blanket insulation.

# END OF SECTION 072100

# SECTION 072200 - ROOFING INSULATION FOR STANDING SEAM OVER METAL DECK

# PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

### 1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
  - 1. Section 07 05 00 Common Work Procedures for Thermal and Moisture Protection.
  - 2. Section 07 62 00 Sheet Metal Flashing and Trim.

# 1.3 REFERENCES

- A. American Society for Testing and materials (ASTM):
  - 1. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
  - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
  - 3. ASTM B29 Standard Specification for Refined Lead.
  - 4. ASTM B32 Standard Specification for Solder Metal.
  - 5. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
  - 6. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
  - 7. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
  - 8. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
  - 9. ASTM C1396 Standard Specification for Gypsum Wallboard.
  - 10.ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 11.ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
  - 12.ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
  - 13.ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
  - 14.ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
  - 15.ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
  - 16.ASTM D312 Standard Specification for Asphalt Used in Roofing.
  - 17.ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - 18.ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 19.ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 20.ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
  - 21.ASTM D2126 Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.

- 22.ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
- 23.ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
- 24.ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
- B. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI)
- C. Factory Mutual Research (FM):1. Roof Assembly Classifications.
- D. National Roofing Contractors Association (NRCA):1. Roofing and Waterproofing Manual.
- E. Underwriters Laboratories, Inc. (UL):1. Fire Hazard Classifications.
- F. Warnock Hersey (WH):1. Fire Hazard Classifications.
- G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- H. Steel Deck Institute, St. Louis, Missouri (SDI)
- I. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB)
- J. Insulation Board, Polyisocyanurate (FS HH-I-1972)
- K. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B)

# 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Division 01 Section Submittal Procedures. 01300.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.
- D. Shop Drawings
  - 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
  - 2. Shop drawing shall include: Outline of roof, location of drains, complete board layout of tapered insulation components, thickness and the average "R" value for the completed insulation system.
- E. Certification
  - 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

# 1.5 QUALITY ASSURANCE

- A. Fire Classification, ASTM E-108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A or B or C] for external fire and meets local or nationally recognized building codes.
- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].
- D. Pre-installation meeting: Refer to Division 07 roofing specifications for pre-installation meeting requirements.

# 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

# PART 2 – PRODUCTS

# 2.1 PRODUCTS, GENERAL

- A. Refer to Division 01 Section "Common Product Requirements."
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.
  - Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
  - Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
  - 3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.

4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

# 2.2 INSULATION MATERIALS

Α. Standing Seam Roofing

Thermal Insulation Properties and Approved Insulation Boards.

- 1. Rigid Polyisocyanurate Roof Insulation; ASTM C1289:
  - Qualities: Rigid, closed cell polyisocyanurate foam core bonded to heavy duty a. glass fiber mat facers.
  - Thickness: Minimum [ 4.25" ]. b.
  - R-Value: Minimum [ 25 ]. C.
  - Compliances: UL, WH or FM listed under Roofing Systems d. Federal Specification HH-I-1972, Class 1.
  - e. Acceptable Products:
    - 1) ENRGY-3; Johns Manville
      - 2) Hytherm; Dow
      - 3) EnergyGuard; GAF
      - 4) Approved Equivalent
  - Thickness: Five eighths (5/8) inch. a.
  - b. R-Value: .2
  - C. R-Value: .5
  - d. R-Value: .6
  - e. Compliances: UL. WH or FM listed under Roofing Systems.
  - Manufacturer: USG f.
- Β. Modified Roofing
  - 1. Tapered Polyisocyanurate Roof Insulation; ASTM C1289:
    - Qualities: Factory Tapered, closed cell polyisocyanurate foam core bonded to a. heavy duty glass fiber mat facers.
    - b. Thickness: Minimum [ ]
    - Average R-Value: Minimum [ ] C.
    - d.
    - Tapered Slope: [\_\_] Compliances: UL, WH or FM listed under Roofing Systems Federal Specification e. HH-I-1972, Class 1
    - Acceptable Products: f.
      - 1) ENRGY 3; Johns Manville
      - 2) EnergyGuard; GAF
      - 3) Approved Equivalent
  - 2. Dens-Deck Prime Roof Board
    - a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
    - Board Size: Four feet by four feet (4'x4'). b.
    - Thickness: One guarter (1/4) inch. C.
    - d. Thickness: One half (1/2) inch.
    - e. Thickness: Five eighths (5/8) inch.
    - R-Value: .28 f.
    - R-Value: .56 g.
    - h. R-Value: .67
    - Compliances: UL, WH or FM listed under Roofing Systems. i.

# 2.3 RELATED MATERIALS

## Stand Seam Roofing:

- A. Fasteners: Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
  - 1. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

### Modified Roofing

- B. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.
  - 1. Acceptable Manufacturers:
    - a. The Garland Company, Inc.
    - b. Celotex
    - c. Johns Manville
    - d. GAF
    - e. Approved Equivalent
- C. Protection Board: Densdeck
- D. Roof Board Joint Tape: Six (6) inches wide glass fiber mat with adhesive compatible with insulation board facers.
- E. Insulock HR, Or Olybond to adhere Densdeck over fastened insulation
- F. Fasteners: Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
  - 2. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

# PART 3 – EXECUTION

# 3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Common Execution Requirements."

# 3.2 INSPECTOR OF SURFACES

- A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.
  - 1. Verify that work which penetrates roof deck has been completed.
  - 2. Verify that wood nailers are properly and securely installed.
  - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
  - 4. Do not proceed until defects are corrected.
  - 5. Do not apply insulation until substrate is sufficiently dry.
  - 6. Broom clean substrate immediately prior to application.
  - 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
  - 8. Verify that temporary roof has been completed.

# 3.3 INSTALLATION

- A. Attachment with Mechanical Fasteners
  - Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one fastener per two square feet shall be installed.
  - 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
  - 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.
  - 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal, wood and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of one and one-half (1 ½) inches.
  - 5. Gypsum and cementitious wood fiber decks: Where the roof deck is visible from the building interior, the contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1 ½ of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.
  - 6. Tape joints of insulation as per manufacturer's requirements.

# 3.4 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

# 3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 072200

SECTION 072201 – ROOFING INSULATION FOR MODIFIED BITUMINOUS OVER METAL DECK

# PART 1 – GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

# 1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
  - 1. Section 07 05 00 Common Work Procedures for Thermal and Moisture Protection.
  - 2. Section 07 62 00 Sheet Metal Flashing and Trim.

# 1.3 REFERENCES

- A. American Society for Testing and materials (ASTM):
  - 1. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
  - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
  - 3. ASTM B29 Standard Specification for Refined Lead.
  - 4. ASTM B32 Standard Specification for Solder Metal.
  - 5. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
  - 6. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
  - 7. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
  - 8. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
  - 9. ASTM C1396 Standard Specification for Gypsum Wallboard.
  - 10.ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 11.ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
  - 12.ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
  - 13.ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
  - 14.ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
  - 15.ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
  - 16.ASTM D312 Standard Specification for Asphalt Used in Roofing.
  - 17.ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - 18.ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 19.ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 20.ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
  - 21.ASTM D2126 Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.

- 22.ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
- 23.ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
- 24.ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
- B. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI)
- C. Factory Mutual Research (FM):1. Roof Assembly Classifications.
- D. National Roofing Contractors Association (NRCA):1. Roofing and Waterproofing Manual.
- E. Underwriters Laboratories, Inc. (UL):1. Fire Hazard Classifications.
- F. Warnock Hersey (WH):1. Fire Hazard Classifications.
- G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- H. Steel Deck Institute, St. Louis, Missouri (SDI)
- I. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB)
- J. Insulation Board, Polyisocyanurate (FS HH-I-1972)
- K. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B)

# 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Division 01 Section Submittal Procedures. 01300.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.
- D. Shop Drawings
  - 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
  - 2. Shop drawing shall include: Outline of roof, location of drains, complete board layout of tapered insulation components, thickness and the average "R" value for the completed insulation system.
- E. Certification
  - 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

# 1.5 QUALITY ASSURANCE

- A. Fire Classification, ASTM E-108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A or B or C] for external fire and meets local or nationally recognized building codes.
- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].
- D. Pre-installation meeting: Refer to Division 07 roofing specifications for pre-installation meeting requirements.

# 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

# PART 2 – PRODUCTS

# 2.1 PRODUCTS, GENERAL

- A. Refer to Division 01 Section "Common Product Requirements."
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.
  - Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
  - Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
  - 3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

> 4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

# 2.2 INSULATION MATERIALS

- 1. Tapered Polyisocyanurate Roof Insulation; ASTM C1289:
  - a. Qualities: Factory Tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
  - b. Thickness: Minimum [\_\_]
  - c. Average R-Value: Minimum [\_\_]
  - d. Tapered Slope: [\_\_]
  - e. Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1
  - f. Acceptable Products:
    - 1) ENRGY 3; Johns Manville
    - 2) EnergyGuard; GAF
    - 3) Approved Equivalent
- 2. Dens-Deck Prime Roof Board
  - a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
  - b. Board Size: Four feet by four feet (4'x4').
  - c. Thickness: One quarter (1/4) inch.
  - d. Thickness: One half (1/2) inch.
  - e. Thickness: Five eighths (5/8) inch.
  - f. R-Value: .28
  - g. R-Value: .56
  - h. R-Value: .67
  - i. Compliances: UL, WH or FM listed under Roofing Systems.

# 2.3 RELATED MATERIALS

- A. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.
  - 1. Acceptable Manufacturers:
    - a. The Garland Company, Inc.
    - b. Celotex
    - c. Johns Manville
    - d. GAF
    - e. Approved Equivalent
- B. Protection Board: Densdeck
- C. Roof Board Joint Tape: Six (6) inches wide glass fiber mat with adhesive compatible with insulation board facers.
- D. Insulock HR, Or Olybond to adhere Densdeck over fastened insulation
- E. Fasteners: Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
  - 1. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

# PART 3 - EXECUTION

# 3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Common Execution Requirements."

# 3.2 INSPECTOR OF SURFACES

- A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.
  - 1. Verify that work which penetrates roof deck has been completed.
  - 2. Verify that wood nailers are properly and securely installed.
  - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
  - 4. Do not proceed until defects are corrected.
  - 5. Do not apply insulation until substrate is sufficiently dry.
  - 6. Broom clean substrate immediately prior to application.
  - 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
  - 8. Verify that temporary roof has been completed.

# 3.3 INSTALLATION

- 1. Approved recovery board one half (1/2) inch thickness shall be installed over base tapered insulation using Insulock HR, or olybond.
- 2. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of one quarter (1/4) inch away from the vertical surface.
- 3. Install no more insulation at one time than can be roofed on the same day.
- 4. Install temporary water cut-offs at completion of each day's work and remove upon resumption of work.
- Cant Strips/Tapered Edge Strips: Install preformed forty five (45) degree cant strip at junctures of vertical surfaces. Provide preformed, tapered edge strips at perimeter of edges of roof that do not terminate at vertical surfaces and/or indicated on the drawings.
- 6. Tape joints of insulation as per manufacturer's requirements.
- A. Attachment with Mechanical Fasteners
  - Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one fastener per two square feet shall be installed.
  - 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
  - 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.
  - 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal, wood and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of one and one-half (1 ½) inches.
  - 5. Gypsum and cementitious wood fiber decks: Where the roof deck is visible from the building interior, the contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1 ½ of penetration cannot be achieved with an Olympic

TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.

6. Tape joints of insulation as per manufacturer's requirements.

# 3.4 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

# 3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 072201

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. Building wrap.
  - 2. Flexible flashing.
- B. Related Requirements:
  - 1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.

# 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.

# 1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

# PART 2 - PRODUCTS

# 2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. DuPont (E.I. du Pont de Nemours and Company); Tyvek Commercial Wrap.
    - b. Raven Industries, Inc; Fortress Pro Weather Protection Barrier.
    - c. Reemay, Inc.; Typar House Wrap.
  - 2. Water-Vapor Permeance: Not less than 20 perms (1150 ng/Pa x s x sq. m) per ASTM E 96/E 96M, Desiccant Method (Procedure A).
  - 3. Air Permeance: Not more than 0.006 cfm/sq. ft. when tested according to ASTM E 1677.

- 4. 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 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 0.030 inch (0.8 mm).
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. DuPont (E.I. du Pont de Nemours and Company); DuPong Flashing Tape.
    - b. Grace Construction Products, a unit of W.R. Grace & Co. Conn.; Vycor Butyl Self Adhered Flashing.
    - c. Raven Industries, Inc; Fortress Flashshield.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.
- C. Nails and Staples: ASTM F 1667.

# 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. Cover sheathing with water-resistive barrier as follows:
  - 1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
  - 2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
  - 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 (100 mm) 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 072726 - FLUID-APPLIED MEMBRANE AIR 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. This Section includes the following:
  - 1. Fluid-applied membrane air barrier, vapor permeable.
- B. Related Sections include the following:
  - 1. Division 04 Section "Unit Masonry" for embedded flashings.
  - 2. Division 06 Section "Sheathing" for wall sheathings.
  - 3. Division 07 Section "Thermal Insulation" for foam-plastic board insulation.
  - 4. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

### 1.3 DEFINITIONS

- A. ABAA: Air Barrier Association of America.
- B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

#### 1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

#### 1.5 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 1. Include details of interfaces with other materials that form part of air barrier.

- C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
- D. Qualification Data: For Applicator.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

# 1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
  - 1. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
- C. Preinstallation Conference: Conduct conference at Project site.
  - 1. Include installers of other construction connecting to air barrier, including roofing, masonry, sealants, windows, glazed curtain walls, and door frames.
  - 2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

# 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions.
- D. Protect stored materials from direct sunlight.

# 1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

# PART 2 - PRODUCTS

#### 2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Membrane:
      - 1) Henry Company; Air-Bloc 07.
      - 2) Henry Company; Air-Bloc 31.
      - 3) Prosoco, Inc.; R-Guard
      - 4) Tremco; ExoAir 220R.
  - 2. Physical and Performance Properties:
    - a. Membrane Air Permeance: Not to exceed 0.004 cfm/ sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.

### 2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.
- C. Counterflashing Strip: Modified bituminous, 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, crosslaminated polyethylene film with release liner backing.
- D. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
- E. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- F. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- G. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43-mm-) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms (2145 ng/Pa x s x sq. m).

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

### 3.3 JOINT TREATMENT

A. Gypsum and Plywood Sheathing: Fill joints up to 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip. Fill joints greater than ¼ inch in accordance with manufacturer's written instructions.

# 3.4 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
  - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window

systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply adhesive-coated transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
  - 1. Adhesive-Coated Transition Strip: Roll firmly to enhance adhesion.
- G. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

# 3.5 AIR BARRIER MEMBRANE INSTALLATION

- A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
  - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions.
  - 1. Vapor-Permeable Membrane Air Barrier: Apply in thickness recommended by manufacturer for the indicated substrate.
- E. Apply strip and transition strip according to air barrier manufacturer's written instructions.
- F. Do not cover air barrier until it has been inspected by Contractor, Architect, applicator and manufacturer's representative.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

# 3.6 FIELD QUALITY CONTROL

A. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:

- 1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
- 2. Continuous structural support of air barrier system has been provided.
- 3. Site conditions for application temperature and dryness of substrates have been maintained.
- 4. Maximum exposure time of materials to UV deterioration has not been exceeded.
- 5. Surfaces have been primed, if applicable.
- 6. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
- 7. Termination mastic has been applied on cut edges.
- 8. Strips and transition strips have been firmly adhered to substrate.
- 9. Compatible materials have been used.
- 10. Transitions at changes in direction and structural support at gaps have been provided.
- 11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
- 12. All penetrations have been sealed.
- B. Remove and replace deficient air barrier components and retest as specified above.

# 3.7 CLEANING AND PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
  - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.
  - 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

# SECTION 07 41 13 - STANDING SEAM METAL ROOF PANELS

PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Work described in this section includes installation of new specified underlayment and specified pre-formed metal roofing system complete with clips, perimeter and penetration flashing, closures, gutters, downspouts and snow retention system.

### 1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions apply to this section.
- B. Related work specified elsewhere:
  - 1. Division 6 Section "Rough Carpentry" for wood nailers and blocking, and for wood-based, structural-use roof deck.
  - 2. Division 7 Section "Roof Insulation"
  - 3. Division 7 Section "Metal Soffit Panels"
  - 4. Division 7 Section "Pre-Finished Metal Siding"
  - 5. Division 7 Section "Joint Sealers"
  - 6. Division 7 Section "Sheet Metal Flashing and Trim"

# 1.3 REFERENCES

- A. American Architectural Manufacturer Association (AAMA):
  - 1. AAMA 501.1 Standard Test Method for Metal Curtain Walls for Water Penetration using Dynamic Pressure.
- B. American Iron and Steel Institute (AISI):
  - 1. 1996 Ed. Specification for the Design of Cold-Formed Steel Structural Members.
- C. American Society of Civil Engineers (ASCE):
  1. ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.
- D. American Society for Testing and Materials (ASTM):
  - 1. A792-96 Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 2. A875-99 Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot Dip Process.
  - 3. A653-96 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
  - 4. B209-96 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 5. D1056-91 Specification for Flexible Cellular Materials Sponge or Expanded Rubber.

- 6. D3575-84 Test Methods for Flexible Cellular Materials made from Olefin Polymers.
- 7. E283-93 Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- 8. E331-86 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- 9. E1592-95 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- 10. E1646-95 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
- 11. E1680-95 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. 1993 Ed. Architectural Sheet Metal Manual, 5th edition.
- F. Underwriters' Laboratories (UL):
  - 1. UL-263 Fire Tests of Building Constructions and Materials.
  - 2. UL-790 Tests for Fire Resistance of Roof Covering Materials.

# 1.4 SUBMITTALS

- A. Shop Drawings
  - 1. Show roofing system with flashings and accessories in plan, sections and details. Include metal thickness' and finishes, panel lengths, joining details, anchorage details, flashings, insulation and special fabrication provisions for termination and penetrations; thermal expansion provisions and special supports.
  - 2. Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing; and provide fastener pullout values.
  - 3. Shop drawings must be specific to this project and completed by the metal panel manufacturer's engineering department. Any and/or all changes recommended by the successful bidder must be approved by the manufacturer in writing prior to submittal.
- B. Product Data: Include manufacturer's detailed material and system description, sealant and closure installation instructions, engineering performance data and finish specifications. Indicate fastener types and spacing; and required fastener pullout values.
- C. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, prepared by a an engineer employed by the system manufacturer as a full-time staff engineer. In no case shall the design loads be taken to be less than those detailed in article 1.9 of this specification.

- D. Design Test Reports: Provide certified test reports from an independent testing laboratory that bear the seal of a registered professional engineer to show compliance with the performance criteria specified in article 1.9. Each of the following test reports must be submitted:
  - 1. ASTM E1592-95: Test results must clearly demonstrate compliance with the following requirements:
    - a. The ultimate test failure load shall be reduced by the safety factor specified in article 1.9 to determine the allowable working load for the panel system.
    - b. The proposed system has been tested to insure that the allowable working load of the panel system meets or exceeds the specified negative wind uplift pressures listed in article 1.9 of this specification for all roof zones.
    - c. The test results are applicable for the panel material, grade, thickness, width, and profile specified. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested.
    - d. The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in article 3.3 C for all roof areas. Clip spacing shall not be increased for any roof zone from that which is specified.
  - 2. ASTM E283-93 and E331-86: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.
  - 3. ASTM E1646-95 and E1680-95: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested. The differential test pressures must be equal to those specified in article 1.9.
  - 4. UL 790: The proposed roof panel shall be listed as a non-combustible roof covering material and be approved for use in a UL classification assembly.
  - 5. UL 263: The panel system shall clearly be shown as approved for use in an UL Construction Assembly which conforms to the construction of this project.
- E. Samples: Provide full scale samples of the following materials and system components. Samples shall be of identical material type, thickness, panel width, and material grade/ alloy/temper as the system specified for this project. Except for item 2, samples may be of any of the manufacturer's standard colors.
  - 1. Submit a twelve (12) inch long by actual width sample of panel showing seam profile and stiffening mesas across the flat pan of the panel. Also include separate snap-on cap with factory applied hot melt sealant beads.
  - 2. Provide a three by five (3 x 5) inch sample of the color selected for this project. The sample shall be the actual specified coating system on a metal substrate.
  - 3. Provide samples of actual system components, including: each type of anchor/clip required, head closure assembly, roll goods, bearing plates and/or framing.

# 1.5 DISCLOSURE OF MATERIALS/ALTERNATE MANUFACTURERS

- A. Disclosure of Materials/Alternate Manufacturers: The materials described herein are the Basis of Design and the type of materials to be used on this project. When a particular make or trade name is specified, it shall be indicative of the minmum standard required. This specification is based on the performance characteristics of the system identified in section 2.1.
  - 1. If a bidder wants to bid a material by a manufacturer not listed in passage 2.1, 3., the bidding Contractor must submit the alternate material/manufacturer to the Architect for approval and include all items in section 1.5 B.
  - 2. The bidder must disclose in his/her bid package the manufacturer that is intended to be used on the Project if other than a listed manufacturer.
  - 3. If no manufacturer is listed in the bidder's bid, the bidder's bid is accepted with the assumption that the Basis of Design manufacturer will be provided and the bidder shall use the Basis of Design manufacturer.
  - 4. Bidder will not be allowed to change materials after the bid opening date.
  - 5. Failure of a panel system to meet all requirements of this specification will result in forfeiture of the bid award.
- B. Alternate (Non-listed) Manufacturers: Alternate Manufacturers are subject to meeting all Design Performance and Warranty requirements. If the bidder wishes to propose an alternate manufacturer and/or material other than that specified, the following manufacturer criteria must be submitted by the bidding contractor to the Architect for approval. Alternate systems will not be considered for approval unless it is submitted by the bidding Contractor, and each of these items has been submitted for review to the Architect and/or Engineer:
  - 1. Submit each item listed in section 1.4 (A through E) for evaluation of the proposed system. Shop drawings for a similar project may be submitted in lieu of shop drawings for this project.
  - 2. Tests shall have been made for identical systems within the ranges of specified performance criteria.
  - 3. Empirical calculations for roof performance shall only be acceptable for positive loads.
  - 4. A list of at least five (5) jobs where the proposed alternate material was used under similar conditions in this region. Each job must be at least five (5) years old, and each must be available for inspection by the Architect and/or Engineer.
  - 5. The standing seam roof panels must be physically manufactured and guaranteed by the material supplier.
  - All products must be in accordance with the Health, Safety and Environmental Control (H, S & E) Regulations, e.g., No asbestos materials, no harmful solvent release materials, etc.
  - 7. In making a request for submission, Bidder/Contractor represents:
    - a. He/she has personally investigated the proposed product or method, and determined that it is equal or superior in all respects to that specified.

- b. He/she will provide the same guarantee for substitution as for the product and method specified.
- c. He/she will coordinate installation of accepted substitution in work, making such changes as may be required for work to be completed in all respects.
- d. He/she waives all claims for additional cost related to substitution, which consequently become apparent.
- e. Cost data is complete and includes all related cost under his/her contract or other contracts, which may be affected by the substitution.
- f. He/she will reimburse the Owner for all redesign cost by the Architect for accommodation of the substitute.
- 8. Manufacturer must not have been in Chapter 11 bankruptcy during the last five (5) years.
- 9. A written statement from the manufacturer stating that they will provide the building owner with site inspections a minimum of three (3) times per week by an experienced, full time employee of the company.
- 10. A copy of manufacturer's 30 year watertight warranty. Warranty must be a single-source manufacturer's waterproofing warranty and must include coverage for all trim, flashing, and penetrations associated with this standing seam roof system. Warranty must be from the same manufacturer as the modified bituminious membrane roof system, and pre-manufactured metal coping cap system.
- 11. Submit a certified copy of the roofing manufacturer's ISO 9001:2008 compliance certificate.
- 12. Proof that the manufacturer has been in business for a minumum number of years equal to the warranty period required for this project.
- C. The Architect and/or Engineer reserves the right to be the final authority on the acceptance or rejection of any or all bids, proposed alternate roofing systems or materials that has met ALL specified requirement criteria.
- D. Alternate material submissions shall be sent only by the bidding contractor to the Architect. Only substitutes approved in writing by the Architect and/or will be considered.
- E. NOTE: Failure to submit substitution package, or any portion thereof requested, may result in disqualification and consideration for that particular contractor's request for manufacturer substitution.
- F. Site Formed Panels: All metal panels must be factory premanufactured and engineered for this project. Panels in excess of shippable length shall be formed on-site. Site formed panels shall meet each of the following requirements:
  - 1. Panels shall be formed on heavy duty factory type rollformers. Roll formers shall gradually form the panel profile utilizing no fewer than twelve (12) forming stations to improve quality and minimize oil canning.

- 2. All tooling shall be polished and tempered to a minimum hardness of Rockwell C 52. Tooling shall be maintained clean and in good working condition. Tooling repairs or modifications made by means of welding, sawing, grinding or the like are unacceptable, as they may contribute to poor quality, aesthetics, and performance of the end product.
- 3. Panels shall be of identical profile and characteristics as factory formed panels and specimens used as the basis of performance tests.
- 4. Sealant shall be factory applied in a separate factory formed snap on cap. Site/field applied seam sealant is unacceptable. Seam caps may be shipped in forty-five (45') or less length and lap spliced over full length panels in accordance with manufacturer's system details.
- 5. Site rollforming equipment shall be operated by a trained full time experienced technician. The installer must provide additional personnel to handle raw materials and finished product as necessary.
- G. Panel Length: Panels shall be one piece from eave to eave with NO splices between panel ends. Spliced panels will not be acceptable.

# 1.6 INSTALLER QUALIFICATIONS

- A. Engage an experienced metal roofing contractor (erector) to install standing seam system who has a minimum of five (5) years experience specializing in the installation of structural standing seam metal roof systems.
- B. Contractor must be certified by manufacturer specified as supplier of structural standing seam system and obtain written certification from manufacturer that installer is approved for installation of specified system. If requested, contractor must supply owner with a copy of this certification.
- Successful contractor is required to maintain a full-time supervisor/foreman who is on the jobsite at all times during installation of new roof system. Foreman must have a minimum of five (5) years experience with the installation of system similar to that specified.
- D. Successful contractor must obtain all components of roof system from a single manufacturer, including any roll good materials if required. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.
- E. If required, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

# 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's responsibility:
  - 1. Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.
  - 2. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

# B. Installer's responsibility:

- 1. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.
- 2. Stack pre-finished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.
- 3. Handle materials to prevent damage to surfaces, edges and ends of panels and sheet metal items. Damaged material shall be rejected and removed from the site.
- 4. Unload wall panels using a boom or crane, supporting the panels in at least two (2) locations during lifting.
- 5. Protect panels from wind-related damages.
- 6. Protect moisture-sensitive materials from the weather.
- 7. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

# 1.8 JOB CONDITIONS

- A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal roofing system.
- B. Protection:
  - 1. Provide protection or avoid traffic on completed roof surfaces.
  - 2. Do not overload roof with stored materials.
  - 3. Support no roof-mounted equipment directly on roofing system.
- C. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place and approved prior to installation of roofing.

# 1.9 DESIGN AND PERFORMANCE CRITERIA

- A. Thermal Expansion and Contraction.
  - 1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
  - 2. The design temperature differential shall be not less than 200 degrees F.
  - 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

- 4. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the Manufacturer. Metal ridge connector may require design as per job conditions by specified manufacturer.
- B. Uniform Wind Uplift Load Capacity.
  - 1. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing given in article 3.3 C.
    - a. Design Code: ASCE 7-05, Method 2 for Components and Cladding.
    - b. Safety Factor: 1.65 after any load reduction or material stress increase.
    - c. Category III Building with an Importance Factor of 1.15.
    - d. Wind Speed:
    - e. Ultimate Pullout Value:
    - f. Exposure Category:
    - g. Design Roof Height:
    - h. Minimum Building Width:
    - i. Roof Radius:

Roof Area

Zone 2 – Eaves and Rakes

Zone 3 – Corners

Mid Half

End Quarter

- 2. Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above. In order to comply with the building code, panel system must be tested to withstand these listed pressures at clip spacings no closer than those listed in article 3.3 C.
- C. Uniform Positive Load Capacity.
  - 1. The installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 35 psf; Ground Snow Load of 35 psf; Balanced Uniform Roof Snow Load of 26.7 psf; Maximum Unbalanced Surcharged Load of 10.7 psf, and an Unbalanced Width of 24.6 feet.
  - 2. Capacity to resist positive loads shall be determined by empirical calculations in accordance with AISI. Calculation shall be sealed by a registered professional engineer.

- 3. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.
- D. Underwriters' Laboratories, Inc., (UL) fire resistance P ratings for roof assemblies: If applicable, panel system shall be approved for use in an appropriate Construction Assembly. as defined by UL 263.
- E. Underwriters' Laboratories, Inc., (UL) fire rating per UL 790.
- F. ASTM E283: Static pressure air infiltration (doors, windows, curtain walls):

1.57 PSF         0.0007 cfm/sq.ft.           6.24 PSF         0.0002 cfm/sq.ft.           20.0 PSF         0.0036 cfm/sq.ft.	Pressure	Leakage Rate
	1.57 PSF 6.24 PSF 20.0 PSF	0.0007 cfm/sq.ft. 0.0002 cfm/sq.ft. 0.0036 cfm/sq.ft.

G. ASTM E331: Static pressure water infiltration (doors, windows, curtain walls):

Pressure

Pressure

Result

Result

5 Gal/Hr Per S.F. and Static No Leakage Pressure Of 20.0 Psf for 15 minutes

H. ASTM E1680: Static pressure air infiltration (roof panels):

Pressure	Leakage Rate
1.57 PSF	0.0012 cfm/sq.ft.
6.24 PSF	0.0001 cfm/sq.ft.
20.0 PSF	0.0011 cfm/sq.ft.

I. ASTM E1646: Static pressure water infiltration (roof panels):

5 Gal/Hr Per S.F. and Static No Leakage Pressure Of 20.0 Psf for 15 minutes

- J. Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.
- K. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.

# 1.10 WARRANTIES

- A. The warranty for both the metal and modified bituminous roof sections shall come from the same one manufacturer. The manufacturer cannot private label their roofing material metal or modified bituminous. There cannot be two separate warranties for the metal roof section and the modified bituminous roof section.
- B. Owner shall receive ONE (1) warranty from manufacturer of roof panels covering all of the following criteria.
  - 1. Manufacturer's 30 year No Dollar Limit (NDL) watertight warranty, including coverage for all trim, flashings, and penetrations associated with the standing seam roof area.
  - 2. 30 year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.
  - 3. Warranty shall commence on date of Substantial Completion.
  - 5. At the request of the Owner, the Manufacturer will provide an annual inspection. The request for annual inspections shall be applicable for the life of the warranty.
- C. In addition to manufacturer's warranty, Installer's Warranty is required to be completed and submitted with close-out documents.
  - Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers and walkway products, for the following warranty period:
    - a. Warranty Period: Two years from date of Substantial Completion.
- D. Manufacturer of roofing system shall be responsible for installer warranty. If Installer is no longer in business at the time of necessary warranty work, covered under either Manufacturer's or Installer's warranties, Manufacturer shall cover Installer's warranty, providing any materials and/or labor necessary to honor the terms of that Warranty.

#### 1.11 MANUFACTURER'S INSPECTIONS

- A. When the project is in progress, the roofing system manufacturer will provide the following:
  - 1. Keep the Architect and/or Engineer informed as to the progress and quality of the work as observed.
  - 2. Provide job site inspections a minimum of three (3) days a week with reports to the Architect.
  - 3. Report to the Architect and/or Engineer in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
    - 4. Confirm after completion that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

#### PART 2 – PRODUCTS

#### 2.1 STANDING SEAM ROOFING SYSTEM A. General.

- 1. Whenever a particular make of material, trade name and/or manufacturer's name is specified herein, it shall be regarded as being indicative of the minimum standard of quality required. A bidder who proposes to quote on the basis of an alternate material and/or system will only be considered if the proposed alternate is submitted and approved as being equivalent or superior in quality to the specified system in accordance with article 1.5. Additionally, all manufacturer and contractor/fabricator guidelines, performance criteria and warranty criteria must be met as specified in Part 1.
- 2. Product names for the metal roof panel system and waterproofing materials used in this section shall be based on performance characteristics of the metal System manufactured by The Garland Company, and shall form the Basis of Design. Any proposed system must meet or exceed the following listed characteristics. Additionally, all performance requirements listed in "Design and Performance Criteria" (article 1.9) and "Warranties" criteria (article 1.10) must be met and submitted as well as all items listed in the Disclosure of Materials/Alternate Manufacturers (article 1.5).
- 3. Manufacturers:
  - 1. Basis of Bid Manufacturer: Garland Company, Inc.
  - 2. Alternate bid Manufacturers:
    - a. Ecology Commercial and Industry Roofing Systems
    - b. Viridian
    - c. Tremco Incorporated
- B. Materials.
  - 1. Panel material: 24 ga., Galvanized steel, smooth as per ASTM A653-96.
  - 2. Flashing and flat stock material: Fabricate in profiles indicated on drawings of same material, thickness and finish as metal roof system, unless indicated otherwise. Gutters, downspouts, leaders and gutter bracket covers shall be fabricated as specified in 0.050" aluminum with a kynar paint finish to match the roof panel.
  - 3. Polyiso Insulation to be installed at minimum of 4.25" thick and fastened as necessary to metal deck prior to underlayment based on wind up lift calculations and required R-Value.
- C. Finish on surfaces:
  - 1. Exposed surfaces for coated panels:
    - a. Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
    - b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.

- c. Color shall be Garland's Standard Color.
- 2. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 .30 dry film thickness (DFT).
- D. Characteristics:
  - 1. Provide the same panel profile from a single manufacturer for ALL standing seam roof areas.
  - 2. Configuration: Provide standing seam panels incorporating mechanically interlocked, concealed anchor clips allowing unlimited thermal movement, and of configuration which will prevent entrance or passage of water.
    - a. Panel/Cap configuration must have a total of four (4) layers of steel surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.
    - b. Profile of panel shall have mesa's every two (2) inches on center continuous throughout panel which are a minimum of one point five (1.5) inches wide. These will absorb thermal stresses, reduce oil canning, and increase load carrying capacity.
    - c. Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at trim details (as per manufacturer's guidelines).
    - d. Panels must be fabricated and furnished in continuous lengths from eave to eave with no joints/splices/overlaps.
    - e. Panels lengths which exceed maximum shipping lengths shall be field rolled on equipment owned by the panel manufacturer. Contractor rolling equipment is NOT allowed. Equipment shall have at least 12 rolling stations and provide a product identical to factory manufactured product. The equipment shall be operated by a trained full time experienced technician.
    - g. Seam caps shall be manufactured in the factory and shall be installed with NO endlaps. Seam sealant must be factory applied.
  - 3. Seam must be two and three-eights (2-3/8) inches minimum height for added upward pressures and aesthetic appeal. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are NOT acceptable.
  - 4. Concealed Standard Anchor Clips: Clips must be sixteen (16) gauge galvanized steel, ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.
    - a. Two-piece (2) clips are NOT acceptable.
    - b. Sealant applied in panel cap must be isolated from clip to insure that no sealant damage occurs from the movement of the panel during expansion and contraction.

- c. Clip must maintain a clearance of a minimum of three-eights (3/8) inches between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.
- 5. Seam cap: Snap-on cap shall be a minimum of 1" wide "T" shaped of continuous length up to forty-five (45) feet according to job conditions and field seamed by means of manufacturer's standard seaming machine.
  - a. Cap shall be designed to receive two (2) beads of continuous hot applied gasketing sealant which will be applied independent of anchor clip to allow unlimited thermal movement of panel without damage to cap sealant.
  - b. Sealant shall be a SIS (Styrene-Isoprene-Styrene) block copolymer type thermoplastic rubber adhesive, non-fatigue water barrier.
- 6. Standing Seam Panel Width: 18"
- 7. Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.
- 8. Replaceability: Panels shall be of a symmetrical design with snap on cap configuration such that individual panels may be removable for replacement without removing adjacent panels.
- 9. Panel ends shall be panned at ridge or where applicable per the manufacturer's approved shop drawings.
- 10. Panel length: Full length without joints/splices/laps.
- E. Accessories.
  - 1. Gable anchor clips: Standing Seam style, galvanized steel, minimum thickness 16 gauge.
  - 2. Fasteners:
    - a. Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements and in accordance with recommendations from the manufacturer of the metal roof decking and wood blocking. Provide #14-13 DPI as the minimum fastener size.
    - b. Exposed fasteners: Series 410 stainless steel fasteners or one-eighth (1/8) inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.
  - 3. Closures: Factory precut closed cell foam meeting ASTM D1056 or ASTM D3575, enclosed in metal channel matching panels when used at ridge, rake, and jamb.
  - 4. Provide all miscellaneous accessories for complete installation.
# 2.2 ACCESSORY PRODUCTS

- A. Sealant:
  - 1. Acceptable product:
    - a. Concealed Application: Basis of design manufacturer Butyl Sealant or approved equal.
    - b. Exposed Application: Basis of design manufacturerTripolymer Sealant or approved equal.
  - 2. Colors: As selected by Architect from sealant manufacturer's standard selection.
- B. Roof Deck Substrate:
  - 1. Continuous metal roof deck over steel roof structure.
- C. Underlayment:
  - 1. Underlayment shall be applied over entire roof area, and turned down over the perimeter edge blocking in accordance with the manufacturer's approved shop drawings.
  - 2. Underlayment shall be designed specifically for use under a metal roofing system; a 40 mil self-adhering, high-temperature underlayment as recommended by the roofing manufacturer.
- D. Bearing Plates:
  - 1. Install bearing plates directly over rigid board insulation/underlayment at each anchor clip location.
  - 2. Bearing plates shall be 3" x 5" x 16 gauge (minimum) galvanized steel.
  - 3. Bearing plates shall be pre-punched with a hole pattern matching that of the panel anchor clips. Slotted holes are acceptable.
- F. Prefabricated Shims:
  - 1. Install prefabricagted high density polyethelene plastic shims under the roof panel clip and over the bearing plates to maintain a level/plumb plane to prevent buckling of the roof panel.
- G. Snow Retention System:
  - Shall be S-5! Snow Retention System as supplied by the standing seam panel manufacturer designed for the appropriate local code ground snow load of 35 psf resulting in the required balanced and unbalanced snow loads, specified roof slopes, radius and lengths, and an 18 inch wide panel. One (1) row of the S-5! Color Guard snow retention system will be required on both eave ends of all roof sections. An S-5! Clip shall be installed at each panel seam, and one (1) Snow Clips between each panel. Color shall match standing seam roof panel color.
- H. Gutters and Downspouts:

- Gutters: Formed from same material as wall panels. Match profile described in drawings, providing complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 10-foot long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced per SMACNA's recommendation based on gauge and stretch-out, fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match standing seam metal roof panels.
- 2. Gutter Brackets: External gutter bracket supports shall be 2-inch wide x ¼-inch thick formed aluminum, and shall be spaced at no greater than 30" on center. Stagger external gutter bracket supports with internal gutter straps. External supports shall be post-painted with a matching full-strength 70 percent PVDF finish, or covered with an aluminum cover matching the roof panel material, and warranted by the panel manufacturer for same term as specified for material finishes.
- 3. Gutter Straps: Internal gutter straps shall be 1-inch wide x 1/8-inch thick formed aluminum, and shall be spaced at no greater than 30" on center. Stagger internal gutter straps with gutter external bracket supports.
- 4. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual". Finish downspouts to match gutters.
- 5. Downspout Brackets: Where detailed, surface mounted downspout protection guards shall be fabricated from ¼-inch thick formed aluminum, and shall be post-painted with a matching full-strength 70 percent PVDF finish and warranted by the panel manufacturer for same term as specified for material finishes.

# 2.3 FABRICATION

- A. Shop fabricate metal roofing and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.
- B. Form flashing components from full single width sheet in minimum ten (10'-0") foot lengths. Provide mitered corners, joined using closed end pop rivets and joint sealant.
- C. Fabricate roofing and related sheet metal work in accord with approved shop drawings and applicable standards.

# PART 3 - EXECUTION

# 3.1 PREPARATION

- A. Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves or buckles in the substrate before proceeding with installation of the pre-formed metal roofing. The installed roof panels will follow the contour of the structure and may appear irregular if not corrected.
- B. Establish straight side and crosswise benchmarks.
- C. Use proper size and length fastener for strength requirements. Approximately five-sixteenths (5/16) inch is allowable for maximum fastener head size beneath the panel.
- D. Rectangular shaped roofs shall be checked for square and straightness. Gable ends may require setting a true line for the gable clips and setting with string line.

- E. Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.
- F. Pre-roofing conference:
  - 1. Prior to beginning metal roofing work, a pre-roofing conference shall be held to review work to be accomplished.
  - 2. Architect, Engineer, Owner, contractor, metal roofing subcontractor, metal roofing system manufacturer's representative and all other subcontractors who have equipment penetrating roof or whose work involves access to roof shall be present.

## 3.2 METAL FABRICATION AND EQUIPMENT

- A. Mechanical panel fabrication for field panels shall be operated by a trained full time experienced technician.
- B. Mechanical equipment shall have a least twelve (12) rolling stations and provide a product identical to factory manufactured product.
- 3.3 ROOFING AND FLASHING INSTALLATION
  - A. Details on the project documents are provided for bidding purposes. All details will be shown on manufacturer's shop drawings to successful bidder. Comply with all details and install roof panels, roofing materials and flashings in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.
  - B. Prepare roof for the installation of standing seam panels, including:
    - 1. Install insulation in accordance with the Division 07 Section "Roof Insulation" spefication, and manufacturer's recommendations. All joints between the layers of insulation shall be staggered in all directions to provide a thermal break.
    - 2. Install the specified and approved underlayment as required in this specification over the installed insulation system. The specified underlayment shall be applied over the entire roof area.
  - C. Directly over the installed and fastened roof insulaton and underlayment (completed roof substrate), install one (1) piece panel anchor clips. All anchor clips will be set on sixteeen (16) gauge galvanized pre-punched bearing plates to distribute the loads on the insulation board, and fastened with two (2) approved fasteners into the metal roof deck based on the following fastener spacing pattern. As required, install prefabricated high density polyethlene plastic shims to maintain a level/plumb surface/plane for the standing seam panel to prevent buckling.

Clip Spacing/Wind Uplift Zones:

- \* Clip spacing shall be mapped into Zones per manufacturers shop drawings that are required by the installer.
- \* This clip spacing must be followed to ensure integrity of the completed installation. These have been determined based on the uplift calculations for the specified roof and the test results of ASTM E-1592.

- D. Installation of Roof Panels: Roof panels can be installed by starting from either end and working towards the opposite end. Due to the symmetrical design of the specified panel system, it is also acceptable to start from the middle of the roof and work toward each end.
  - 1. Stainless steel pop rivets shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located on either side of the curved apex of the roof. The panel is then anchored at both sides of each of the clip. Three (3) rivets per panel are required and shall be installed.
    - a. Be sure to capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.
    - b. Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately as they are installed.
  - 2. The seam caps are shipped with two (2) beads of factory applied hot melt sealant located inside the caps. To install the caps, hook one side of the cap over the panel edge and rotate over the opposite panel leg. For ease of installation, start at one end of the panel and work toward the opposite end.
  - 3. A hand crimping tool is used to crimp the cap around the top of two adjacent panels
  - 4. Caps shall then be permanently seamed with manufacturers mechanical seamer.
  - 5. At the end of each day's work, seam caps shall be mechanically seamed or hand crimped (crimp 4 inches every 8 feet) to reduce the possibility of wind damage prior to completion of the project.
  - 6. Un-installed panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day's work to prevent possible damage or injury.
- E. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.
- F. Limit exposed fasteners to extent indicated on shop drawings.
- G. Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels, clips, or anchors. Attach clips to structural substrate using fasteners of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.
- H. Seal laps and joints in accordance with roofing system manufacturer's product data.
- I. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.
- J. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

- K. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.
- L. Maximum variation from true planes or lines shall be one-fourth (1/4) inch in twenty (20) feet and three-eighth (3/8) inch in forty (40) feet or more.
- M. Form joints in linear sheet metal to allow for one-fourth (1/4) inch minimum expansion at twenty (20) feet on center maximum and eight (8) feet from corners.
- N. At joints in linear sheet metal items, set sheet metal items in two(2), one-fourth (1/4) inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.
- O. Remove damaged work and replace with new, undamaged components.
- P. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.
- Q. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.
- R. Snow Retention System
  - At every location called out by the architectural drawings install one (1) row of the S-5! Color Guard Snow retention system as as supplied by the standing seam panel manufacturer in accordance with the manufacturer's recommendations. S-5! Clamps are require at EACH panel seam, and the S-5! Clamp set screws shall be tightened to a tension of 115 in-lbs per each screw. Additionally, a S-5! Snow Clip is required in each panel.

END OF SECTION 07 41 00

# INSULATION FOR STANDING SEAM METAL ROOF OVER METAL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

## 1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
  - 1. Section 07 05 00 Common Work Procedures for Thermal and Moisture Protection.
  - 2. Section 07 62 00 Sheet Metal Flashing and Trim.

## 1.3 REFERENCES

- A. American Society for Testing and materials (ASTM):
  - 1. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
  - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
  - 3. ASTM B29 Standard Specification for Refined Lead.
  - 4. ASTM B32 Standard Specification for Solder Metal.
  - 5. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
  - 6. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
  - 7. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
  - 8. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
  - 9. ASTM C1396 Standard Specification for Gypsum Wallboard.
  - 10. ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 11. ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
  - 12. ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
  - 13. ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
  - 14. ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
  - 15. ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
  - 16. ASTM D312 Standard Specification for Asphalt Used in Roofing.
  - 17. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - 18. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - 19. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
  - 20. ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
  - 21. ASTM D2126 Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.
  - 22. ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
  - 23. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
  - 24. ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
- B. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI)
- C. Factory Mutual Research (FM):
  - 1. Roof Assembly Classifications.

- D. National Roofing Contractors Association (NRCA):
  1. Roofing and Waterproofing Manual.
- E. Underwriters Laboratories, Inc. (UL):1. Fire Hazard Classifications.
- F. Warnock Hersey (WH):1. Fire Hazard Classifications.
- G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- H. Steel Deck Institute, St. Louis, Missouri (SDI)
- I. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB)
- J. Insulation Board, Polyisocyanurate (FS HH-I-1972)
- K. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B)

## 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Division 01 Section Submittal Procedures. 01300.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.
- D. Shop Drawings
  - 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
  - 2. Shop drawing shall include: Outline of roof, location of drains, complete board layout of tapered insulation components, thickness and the average "R" value for the completed insulation system.
- E. Certification
  - 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

## 1.5 QUALITY ASSURANCE

- A. Fire Classification, ASTM E-108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A or B or C] for external fire and meets local or nationally recognized building codes.

- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].
- D. Pre-installation meeting: Refer to Division 07 roofing specifications for pre-installation meeting requirements.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

## PART 2 – PRODUCTS

- 2.1 PRODUCTS, GENERAL
  - A. Refer to Division 01 Section "Common Product Requirements."
  - B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
  - C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.
    - 1. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
    - 2. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
    - 3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
    - 4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

## 2.2 INSULATION MATERIALS

- A. Thermal Insulation Properties and Approved Insulation Boards.
  - 1. Rigid Polyisocyanurate Roof Insulation; ASTM C1289:
    - a. Qualities: Rigid, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
    - b. Thickness: Minimum [\_4.25"\_].
    - c. R-Value: Minimum [\_25\_].

- d. Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1.
- e. Acceptable Products:
  - 1) ENRGY-3; Johns Manville
    - 2) Hytherm; Dow
    - 3) EnergyGuard; GAF
    - 4) Approved Equivalent
- a. Thickness: Five eighths (5/8) inch.
- b. R-Value: .2
- c. R-Value: .5
- d. R-Value: .6
- e. Compliances: UL. WH or FM listed under Roofing Systems.
- f. Manufacturer: USG

## 2.3 RELATED MATERIALS

- A. Fasteners: Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
  - 1. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

## PART 3 – EXECUTION

- 3.1 EXECUTION, GENERAL
  - A. Comply with requirements of Division 01 Section "Common Execution Requirements."
- 3.2 INSPECTOR OF SURFACES
  - A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.
    - 1. Verify that work which penetrates roof deck has been completed.
    - 2. Verify that wood nailers are properly and securely installed.
    - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
    - 4. Do not proceed until defects are corrected.
    - 5. Do not apply insulation until substrate is sufficiently dry.
    - 6. Broom clean substrate immediately prior to application.
    - 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
    - 8. Verify that temporary roof has been completed.

## 3.3 INSTALLATION

- A. Attachment with Mechanical Fasteners
  - 1. Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one fastener per two square feet shall be installed.
  - 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.

- 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.
- 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal, wood and structural concrete decks where not specified by the manufacturer. For gypsum and cement-wood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of one and one-half (1 ½) inches.
- 5. Gypsum and cementitious wood fiber decks: Where the roof deck is visible from the building interior, the contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1 ½ of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.
- 6. Tape joints of insulation as per manufacturer's requirements.

# 3.4 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

# 3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION

## SECTION 074213.13 - FORMED METAL WALL 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. Concealed-fastener, lap-seam metal wall panels with reveals.
  - B. Related Sections:
    - 1. Section 074213.53 "Metal Soffit Panels" for metal panels used in horizontal soffit applications.

#### 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 each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
  - 1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
  - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

## 1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show 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 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - 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. General Performance: Metal wall panel assemblies shall be furnished and installed without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Rainscreen Wall System Performance Rating. The metal wall panel assemblies, and the substructural furring/framing system supporting the panels shall be tested in accordance with AAMA 509 and achieve the following performance results:
  - 1. Water Infiltration: The water infiltration performance of the metal wall panel assembly shall not exceed the classification of W-1.
  - 2. Back Ventilation: The air ventilation performance of the rainscreen cavity air space shall have a minimum classification of V-4.
- C. Rainscreen Wall System Performance Rating. The metal wall panel assemblies, and the substructural furring/framing system supporting the panels shall be tested in accordance with AAMA 508-07 and achieve the following performance results: PASS.
- D. Abrasion Resistance of Underside Coating for Zinc Wall Panels.

- 1. The underside of all zinc roof panel and flashing materials shall be coated with a high performance abrasion resistant coating to prevent corrosion from the underside due to condensation and/or water vapor.
- 2. The underside coating shall provide a minimum abrasion resistance equal to 250 liters of falling sand, as testing in accordance with ASTM D968, Method A.
- E. Thermal Expansion and Contraction.
  - 1. Completed metal wall panel and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, or reducing performance ability.
  - 2. The design temperature differential shall be not less than 220 degrees Fahrenheit.
  - 3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
- F. Uniform Wind Load Capacity.
  - 1. Installed wall system shall withstand negative wind pressures complying with the following criteria.
    - a. Design Code: ASCE 7-05, Method 2 for Components and Cladding.
    - b. Safety Factor: The metal panel system shall be tested to proof load of 1.5 times the design service load condition, as required by the ASTM E330 method.
    - c. Wind loads as indicated on drawings.

# 2.2 LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Wide-Reveal-Joint, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and a stepped profile between panel edges, resulting in a wide reveal joint between panels.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide 'Element' as manufactured by Innovative Metals Company, Inc (IMETCO) or a pre-approved product by one of the following:
    - a. Centria Architectural Systems
    - b. Fabral
    - c. Petersen Aluminum Corporation
    - d. Morin, A Kingspan Group Company.
    - e. Sobotec
  - Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Thickness: 20 Gauge
    - b. Exterior Finish: Two-coat fluoropolymer.

- c. Color: As selected by Architect from manufacturer's standard and premium selections.
- 3. Panel Coverage: as indicated on drawings
- 4. Panel Height: as indicated on drawings
- 5. Orientation: Vertical & Horizontal

## 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support, alignment and ventilation of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, corner trim, reveals, backerboard, anchor clips, ventilation strips and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
  - Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-(25-mm-)thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

## 2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements

demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.
  - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

# 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
  - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent 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.
  - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

#### 3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:

- 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
  - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
  - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  - 3. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  - 4. Flash and seal panels with weather closures at perimeter of all openings.
- E. Watertight Installation:
  - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
  - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
  - 3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
  - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

# 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 074213.53 - METAL SOFFIT 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 metal soffit panels.
- B. Related Sections:
  - 1. Section 074213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

#### 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 each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
  - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.
  - B. Sample Warranties: For special warranties.

#### METAL SOFFIT PANELS

#### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical roof eave, including fascia, and soffit as shown on Drawings; approximately four panels wide by full eave width, including attachments and accessories.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

#### 1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

# 1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show 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 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - 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. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

# 2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile Metal Soffit Panels: Perforated flat panels formed with a V- joint between panels and a V-groove mid panel.
  - 1. Basis of Design Proiduct: Subject to compliance with requirements, provide SP Series as manufactured by Innovative Metals Company, Inc (IMETCO) or an approved product by one of the following:
    - a. Centria Architectural Systems
    - b. Fabral
    - c. Petersen Aluminum Corporation
    - d. Morin, A Kingspan Group Company
  - 2. Material: Same material as metal wall panels.
  - 3. Color: To be selected by Architect from full range of manufacturer's standard, premium and woodgrain color selections. (manufacturer must have woodgrain selections to be approved).
  - 4. Panel Coverage: 12 inches (203 mm).
  - 5. Panel Height: 3/8 inch.
  - 6. Vented Soffit: Provide 20% vented panels, spaced every 5<sup>th</sup> panel, full length of run.

## 2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-(25-mm-)thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

## 2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

- 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
- 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
  - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
  - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

## 3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
  - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
  - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

- 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
  - 1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

# 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.53

## SECTION 07 52 50 - MODIFIED BITUMINOUS MEMBRANE ROOFING

## PART 1 GENERAL

- 1.1 SECTION INCLUDES
  - A. Cold Applied 2-Ply Asphalt Roofing

## **RELATED SECTIONS**

- A. Section 05 31 00 Metal Roof Deck.
- B. Section 06 10 00 Rough Carpentry.
- C. Section 06114 Wood Blocking and Curbing: Wood nailers and cant strips.
- D. Section 07220 Insulation Board: Insulation and fastening.
- E. Section 07 62 00 Sheet Metal Flashing and Trim: Weather protection for base flashings.
- F. Section 07 72 00 Roof Specialties: Counter flashing gravel stops, and fascia.
- G. Section 07 72 33 Roof Hatches: Frame and integral curb; Counter flashing.
- H. Section 08 95 20 Insulated Translucent Wall System: Counter flashing

## 1.2 REFERENCES

- A. ASTM D 4 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
- B. ASTM D 312 Standard Specification for Asphalt used in Roofing.
- C. ASTM D 451 Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
- D. ASTM D 1970– Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.
- E. ASTM D 1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
- F. ASTM D 1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- G. ASTM D 1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.
- H. ASTM D 2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- I. ASTM D 2822 Standard Specification for Asphalt Roof Cement.

- J. ASTM D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
- K. ASTM D 4601– Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
- L. ASTM D 5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
- M. ASTM D 6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
- N. ASTM D 6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
- O. ASTM D 6164 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- P. ASTM D 6754 Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing.
- Q. ASTM D 6757 Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing.
- R. ASTM E 108 Standard Test Methods for Fire Test of Roof Coverings
- S. Factory Mutual Research (FM): Roof Assembly Classifications.
- T. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- U. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Architectural Sheet Metal Manual.
- V. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
- W. Warnock Hersey (WH): Fire Hazard Classifications.
- X. ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.
- Y. ASCE 7, Minimum Design Loads for Buildings and Other Structures
- Z. UL Fire Resistance Directory.
- AA. FM Approvals Roof Coverings and/or RoofNav assembly database.

## 1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Perform work in accordance with all federal, state and local codes.
- B. Design Requirements:
  - 1. Uniform Wind Uplift Load Capacity TBD
    - A. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
      - 1) Design Code: ASCE 7, Method 2 for Components and Cladding.

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- 2) Importance Category:
- 3) Importance Factor of:
- 4) Wind Speed:
- 5) Ultimate Pullout Value:
- 6) Exposure Category: С.
  - a.
- 7) Design Roof Height:
- 8) Minimum Building Width:
- 9) Roof Pitch:
- 10) Roof Area Design Uplift Pressure:
  - a. Zone 1 -
  - b. Zone 2 -c. Zone 3 -
- 2. Live Load: Do not to exceed building design criteria.
- 3. Dead Load:
  - A. Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

#### SUBMITTALS 1.4

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - Preparation instructions and recommendations. 1.
  - Storage and handling requirements and recommendations. 2.
  - Installation instructions. 3.
- C. Shop Drawings: Submit shop drawings including installation details of roofing, flashing, fastening, insulation and vapor barrier, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.
- D. Design Pressure Calculations: Submit design pressure calculations for the roof area in accordance with ASCE 7 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins.
- E. Verification Samples: For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- F. Manufacturer's Certificates: Provide to certify products meet or exceed specified requirements.
- G. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147. Testing must be performed at 77 deg. F. Tests at 0 deg. F will not be considered.
- H. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with

fire and extended coverage insurance on roofing and associated work. Provide a manufacturer's example of an inspection report that includes photographic evidence of rejection, corrective action, and acceptance of roofing installation. Provide a signed letter of the manufacturer stating that they will inspect the job at least three days a week during installation for the duration of the project.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last 20 years.
- C. <u>3 days per week</u> inspection reports to owner from full time material manufacturer's employee. The reports will include pictures of the day's progress made by the contractor and a detailed written report as to the work performed that day.
- D. Installer Qualifications: Company specializing in performing Work of this section with minimum 10 years documented experience and a certified Pre-Approved Manufacturer contractor. They shall not have filed for Bankruptcy in the last 10 years.
- E. The manufacturer must have a current ratio of 5:1 (current assets to current liabilities) and demonstrate such with an audited financial statement supported by an affidavit from a third party. Manufacturer must not have settled litigation or paid fines to a public agency in excess of \$20 million dollars. The manufacturer must also have current ISO 9001:2000 certification for the manufacturing of the products to be utilized on this project.
- F. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.
- G. Roofing manufacturer's inspector must have a minimum of 3 years' experience with said roofing manufacturer and be an employee of the manufacturer warranting the roof system. A signed affidavit should be submitted as to the hire date of said employee of roofing manufacturer.
- H. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
- I. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

# 1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section.
- B. Review installation procedures and coordination required with related Work.

1. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.
- B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.
- C. Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface. No wet or damaged materials will be used in the application.
- D. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.
- E. Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.
- F. Adhesive storage shall be between the range of above 40 degree F (4 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

## 1.8 COORDINATION

A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

## 1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## 1.10 WARRANTY

- A. Upon completion of the work, provide the Manufacturer's written and signed <u>30 year Edge-To-Edge No Dollar Limit System Warranty</u>, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installer, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition including Same Manufacturer's Metal Edge components and Metal Roof Panels/Wall Panels.
  - 1. Warranty Period:
    - A. 30 years from date of acceptance.
- B. Installer is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work.
  - 1. Warranty Period:
    - A. 3 years from date of acceptance.
- C. The warranty for both the metal and modified bituminous roof sections shall come from the

MODIFIED BITUMINOUS MEMBRANE ROOFING

same one manufacturer. The manufacturer cannot private label their roofing material metal or modified bituminous. There cannot be two separate warranties for the metal roof section and the modified bituminous roof section.

- D. The material manufacturer will provide an annual inspection for the duration of the warranty at the request of the owner at no additional charge.
- E. The warranty shall cover all roof related components installed under this specification and shall not be limited to only those materials supplied by the material supplier issuing the warranty.
- F. Specifically The warranty submitted by the manufacturer of record will cover:
  - 1. All labor.
  - 2. Materials by the manufacturer of record.
  - 3. Materials by others.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis of Design Manufacturer: The Garland Company, Inc.
- B. Alternate bid Manufacturers:
  - 1. Ecology Commercial and Industry Roofing Systems
  - 2. Viridian
  - 3. Tremco Incorporated
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 63 00.
- D. The Products specified are intended and the Standard of Quality for the products required for this project. If other products are proposed the bidder must disclose in the bid the manufacturer and the products that they intend to use on the Project. If no manufacturer and products are listed, the bid may be accepted only with the use of products specified.
  - 1. Bidder will not be allowed to change materials after the bid opening date.
  - 2. If alternate products are included in the bid, the products must be equal to or exceed the products specified. Supporting technical data shall be submitted to the Architect/ Owner for approval prior to acceptance.
  - 3. In making a request for substitution, the Bidder/Roofing Contractor represents that it has:
    - A. Personally investigated the proposed product or method, and determined that it is equal or superior in all respects to that specified.
    - B. Will provide the same guarantee for substitution as for the product and method specified.
    - C. Will coordinate installation of accepted substitution in work, making such changes as may be required for work to be completed in all respects.
    - D. Will waive all claims for additional cost related to substitution, which consequently become apparent.
    - E. Cost data is complete and includes all related cost under his/her contract or other contracts, which may be affected by the substitution.

- F. Will reimburse the Owner for all redesign cost by the Architect for accommodation of the substitution.
- 4. Architect/ Owner reserves the right to be the final authority on the acceptance or rejection of any or all bids, proposed alternate roofing systems or materials that has met ALL specified requirement criteria.
- 5. Failure to submit substitution package, or any portion thereof requested, will result in immediate disqualification and consideration for that particular contractors request for manufacturer substitution.
- 2.2 Roofing Sheet Materials
- 2.3 INSULATION ON MODIFIED ROOF SECTION AS INDICATED ON DRAWINGS
  - A. 2" Paver on pedestals on 2 Ply Modified Roof. Polyiso Insulation should be fastened based on wind up lift calculations and coverboard adhered. This shall also meet R-Value Requirements indicated on drawings.
  - B. Base Bid
    - 1. Base (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive:
      - a. 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
    - 2. Modified Cap (Ply) Sheet: One ply bonded to the prepared substrate with InterplyAdhesive:
      - a. 160 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber, fire retardant additives and reinforced with a fiberglass and polyester composite scrim. Surfaced with the highly reflective Sunburst white mineral. ASTM D 6162, Type III Grade G
    - 3. Interply Adhesive: (1 and 2)
      - a. Polymer modified cold process asphalt roofing bitumen V.O.C. compliant ASTM D 3019.
    - 4. Flashing Base Ply: One ply bonded to the prepared substrate with Interply Adhesive:
      - a. 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
    - 5. Flashing Cap (Ply) Sheet: One ply bonded to the prepared substrate with InterplyAdhesive:
      - a. 160 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber, fire retardant additives and reinforced with a fiberglass and polyester composite scrim. Surfaced with the highly reflective Sunburst white mineral. ASTM D 6162, Type III Grade G
    - 6. Flashing Ply Adhesive:
      - a. Brush grade flashing adhesive

## PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.
- C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been

properly completed.

D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

## 3.2 PREPARATION

- A. General: Clean surfaces thoroughly prior to installation.
  - 1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
  - 2. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
  - 3. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
  - 4. Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
  - 5. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
  - 6. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
  - 7. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.
- 3.3 INSTALLATION GENERAL
  - A. Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.
  - B. General: Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
    - 1. Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
    - 2. Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.
  - C. Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water
  - D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the

upper edge of the membrane when strapping the plies.

## 3.4 INSTALLATION COLD APPLIED ROOF SYSTEM

- A. Modified Cap Ply(s): Cut cap ply sheets into 18 foot lengths and allow plies to relax before installing. Install in interplay adhesive applied at the rate required by the manufacturer. Shingle sheets uniformly over the prepared substrate to achieve the number of plys specified. Shingle in proper direction to shed water on each large area of roofing.
  - 1. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
  - 2. Solidly bond to the base layers with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
  - 3. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Care should be taken to eliminate air entrapment under the membrane.
  - 4. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
  - 5. Allow cold adhesive to set for 5 to 10 minutes before installing the top layer of modified membrane.
  - 6. Extend membrane 2 inches beyond top edge of all cants in full moppings of the cold adhesive as shown on the Drawings.
- B. Fibrous Cant Strips: Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.
- C. Wood Blocking, Nailers and Cant Strips: Provide wood blocking, nailers and cant strips per requirements of Section 06 10 00.
  - 1. Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
  - 2. Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
  - 3. Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
  - 4. Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.
- D. Metal Work: Provide metal flashings, counter flashings, parapet coping caps and thru-wall flashings as specified in Section 07 62 00. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.
- E. Termination Bar: Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.
- F. Flashing Base Ply: Install flashing sheets by the same application method used for the base ply.
  - 1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.

- 2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
- 3. Adhere to the underlying base ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
- 4. Solidly adhere the entire flashing ply to the substrate. Secure the tops of all flashings that are not run up and over curb through termination bar fastened at 6 inches (152 mm) O.C. and sealed at top.
- 5. Seal all vertical laps of flashing ply with a three-course application of trowel-grade mastic and fiberglass mesh.
- 6. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
- 7. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work.
- 8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.
- G. Flashing Cap Ply: Install flashing cap sheets by the same application method used for the base ply.
  - 1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
  - 2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
  - 3. Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
  - 4. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
  - 5. Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
  - 6. All stripping shall be installed prior to flashing cap sheet installation.
  - 7. Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
  - 8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.
- H. Roof Walkways: Provide walkways in areas indicated on the Drawings.

# 3.5 INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

- A. Scupper Through Wall:
  - 1. Inspect the nailer to assure proper attachment and configuration.
  - 2. Run one ply over nailer, into scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
  - 3. Install a scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed and soldered. Prime scupper at a rate of 100 square feet per gallon and allow to dry.
- 4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
- 5. Strip in flange of scupper box with base flashing ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.
- 6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.
- B. Scupper Through Wall (Overflow):
  - 1. Inspect the nailer to assure proper attachment and configuration.
  - 2. Run one ply over nailer up the overflow, into the scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
  - 3. Install scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed and soldered. Prime scupper at a rate of 100 square feet per gallon and allow to dry.
  - 4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
  - 5. Strip in flange scupper box with base flashing ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.
  - 6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.
- C. Expansion Joint:
  - 1. Minimum curb height is 8 inches (203 mm) above finished roof height. Chamfer top of curb. Prime vertical curb at a rate of 100 square feet per gallon and allow to dry.
  - 2. Mechanically attach wood cant to expansion joint nailers. Run all field plies over cant a minimum of 2 inches (50 mm).
  - 3. Install compressible insulation in neoprene cradle.
  - 4. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
  - 5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
  - Install pre-manufactured expansion joint cover. Fasten sides at 12 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.
- D. Area Divider:
  - 1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical curb at a rate of 100 square feet per gallon and allow to dry.
  - 2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
  - 3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm)on to field of the roof.
  - 4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
  - 5. Install pre-manufactured cover. Fasten sides at 24 inches (609 mm) o.c. with fasteners and neoprene washers through slotted holes. Furnish all joint cover laps with butyl tape between metal covers.
- E. Equipment Support:

- 1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
- 2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
- 3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
- 4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
- 5. Install pre-manufactured cover. Fasten sides at 24 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.
- 6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.
- F. Curb Detail/Air Handling Station:
  - 1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
  - 2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
  - 3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
  - 4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
  - 5. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
  - 6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.
- G. Exhaust Fan:
  - 1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
  - 2. Set cant in bitumen. Run all plies over cant a minimum of 2 inches (50 mm).
  - 3. Install base flashing ply covering curb with 6 inches (152 mm) on to field of the roof.
  - 4. Install a second ply of modified flashing ply installed over the base flashing ply, 9 inches (228 mm) on to field of the roof. Attach top of membrane to top of wood curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
  - 5. Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendation.
- H. Roof Drain:
  - 1. Plug drain to prevent debris from entering plumbing.
  - 2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
  - 3. Run roof system plies over drain. Cut out plies inside drain bowl.
  - 4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper at a rate of 100 square feet per gallon and allow to dry.
  - 5. Install base flashing ply (40 inch square minimum) in bitumen.
  - 6. Install modified membrane (48 inch square minimum) in bitumen.
  - 7. Install clamping ring and assure that all plies are under the clamping ring.
  - 8. Remove drain plug and install strainer.
- I. Plumbing Stack:

- 1. Minimum stack height is 12 inches (609 mm).
- 2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
- 3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
- 4. Install base flashing ply in bitumen.
- 5. Install membrane in bitumen.
- 6. Caulk the intersection of the membrane with elastomeric sealant.
- 7. Turn sleeve a minimum of 1 inch (25 mm) down inside of stack.
- J. Pitch Pocket:
  - 1. Run all plies up to the penetration.
  - 2. Place the pitch pocket over the penetration and prime all flanges.
  - 3. Strip in flange of pitch pocket with one ply of base flashing ply. Extend 6 inches (152 mm) onto field of roof.
  - 4. Install second layer of modified membrane extending 9 inches (228 mm) onto field of the roof.
  - 5. Fill pitch pocket half full with non-shrink grout. Let this cure and top off with pourable sealant.
  - 6. Caulk joint between roof system and pitch pocket with roof cement.
- K. Liquid Flashing:
  - 1. Mask target area on roof membrane with tape.
  - 2. Clean all non-porous areas with isopropyl alcohol.
  - 3. Apply 32 wet mil base coat of liquid flashing over masked area.
  - 4. Embed polyester reinforcement fabric into the base coat of the liquid flashing.
  - 5. Apply 48-64 wet mil top coat of the liquid flashing material over the fabric extending 2 inches (51 mm) past the scrim in all directions.
  - 6. Apply minerals immediately or allow the liquid flashing material to cure 15-30 days and then install reflective coating.

### 3.6 CLEANING

- A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- B. Remove asphalt markings from finished surfaces.
- C. Repair or replace defaced or disfigured finishes caused by Work of this section.

### 3.7 PROTECTION

- A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.
- B. Protect exposed surfaces of finished walls with tarps to prevent damage.
- C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.
- D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.

E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

## 3.8 FIELD QUALITY CONTROL

- A. Field observations shall be performed a minimum of 3 times per week by a Sales Representative employed full-time by the manufacturer and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.
  - 1. Warranty shall be issued upon manufacturer's acceptance of the installation.
- B. Provide observation reports from the Sales Representative indicating procedures followed, weather conditions and any discrepancies found during inspection atleast once a week to the architect
  - 1. Provide a final report from the Sales Representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

# 3.9 SCHEDULES

- A. Base (Ply) Sheet:
  - 1. (80 mil): 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
    - A. Tensile Strength, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 50 lbf/in XD 50 lbf/in
      - 2) 50mm/min. @ 23 +/- 2 deg. C MD 8.75 kN/m XD 8.75 kN/m
    - B. Tear Strength, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 100 lbf XD 100 lbf
      - 2) 50mm/min. @ 23 +/- 2 deg. C MD 444.8 N XD 444.8 N
    - C. Elongation at Maximum Tensile, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 2.0 % XD 2.0 %
      - 2) 50mm/min@ 23 +/- 2 deg. C MD 2.0 % XD 2.0 %
    - D. Low Temperature Flexibility, ASTM D 5147, Passes -20 deg. F (-28.8 deg. C)
- B. Thermoplastic/Modified Cap (Ply) Sheet:
  - 1. 160 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber, fire retardant additives and reinforced with a fiberglass and polyester composite scrim. Surfaced with the highly reflective Sunburst white mineral. ASTM D 6162, Type III Grade G
    - A. Tensile Strength, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 700 lbf/in XD 750 lbf/in
      - b. 50 mm/min. @ 23 +/- 2 deg. C MD 122.5 kN/m XD 131.25 kN/m
    - B. Tear Strength, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1300 lbf XD 1400 lbf
      - b. 50 mm/min. @ 23 +/- 2 deg. C MD 5783 N XD 6227 N
    - C. Elongation at Maximum Tensile, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6.0% XD 6.0%
      - b. 50 mm/min. @ 23 +/- 2 deg. C MD 6.0% XD 6.0%
    - D. Low Temperature Flexibility, ASTM D 5147, Passes -30 deg. F (-34 deg. C)
    - E. Reflectivity, ASTM C 1549: 73%
- C. Interply Adhesive:

- 1. Polymer modified cold process asphalt roofing bitumen V.O.C. compliant ASTM D 3019. Performance Requirements:
  - A. Non-Volatile Content ASTM D 4479 70%
  - B. Density ASTM D1475 8.9 lbs./gal.
  - C. Viscosity Stormer ASTM D562 400-500 grams
  - D. Flash Point ASTM D 93 100 deg. F min. (37 deg. C)
  - E. Slope: up to 3:12
- D. Flashing Base Ply:
  - 1. 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
    - A. Tensile Strength, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 50 lbf/in XD 50 lbf/in
      - 2) 50mm/min. @ 23 +/- 2 deg. C MD 8.75 kN/m XD 8.75 kN/m
    - B. Tear Strength, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 100 lbf XD 100 lbf
      - 2) 50mm/min. @ 23 +/- 2 deg. C MD 444.8 N XD 444.8 N
    - C. Elongation at Maximum Tensile, ASTM D 5147
      - 1) 2 in/min. @ 73.4 +/- 3.6 deg. F MD 2.0 % XD 2.0 %
      - 2) 50mm/min@ 23 +/- 2 deg. C MD 2.0 % XD 2.0 %
    - D. Low Temperature Flexibility, ASTM D 5147
      - 1) Passes -20 deg. F (-28.8 deg. C)
- E. Flashing Ply Adhesive:
  - Brush grade flashing adhesive.
  - A. Non-Volatile Content ASTM D 4479 70 min.
  - B. Density ASTM D 1475 8.6 lbs./gal. (1kg/l)
  - C. Flash Point ASTM D 93 100 deg. F (37 deg. C)
- F. Surfacing:

1.

- 1. Flashing Cap (Ply) Sheet:
  - A. Base Bid: 160 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post-consumer recycled rubber, fire retardant additives and reinforced with a fiberglass and polyester composite scrim. Surfaced with the highly reflective Sunburst white mineral. ASTM D 6162, Type III Grade G
    - 1) Tensile Strength, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 700 lbf/in XD 750 lbf/in
      - b. 50 mm/min. @ 23 +/- 2 deg. C MD 122.5 kN/m XD 131.25 kN/m
    - 2) Tear Strength, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 1300 lbf XD 1400 lbf
      - b. 50 mm/min. @ 23 +/- 2 deg. C MD 5783 N XD 6227 N
    - 3) Elongation at Maximum Tensile, ASTM D 5147
      - a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 6.0% XD 6.0%
        - 50 mm/min. @ 23 +/- 2 deg. C MD 6.0% XD 6.0%
    - 4) Low Temperature Flexibility, ASTM D 5147, Passes -30 deg. F (-34 deg. C)
    - 5) Reflectivity, ASTM C 1549: 73%

END OF SECTION 07 52 50

MODIFIED BITUMINOUS MEMBRANE ROOFING

b.

# INSULATION FOR MODIFIED ROOF SECTIONS

### PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

### 1.2 SUMMARY

- A. Section includes roof insulation over the properly prepared deck substrate.
- B. Related Sections:
  - 1. Section 07 05 00 Common Work Procedures for Thermal and Moisture Protection.
  - 2. Section 07 62 00 Sheet Metal Flashing and Trim.

# 1.3 REFERENCES

- A. American Society for Testing and materials (ASTM):
  - 1. ASTM A167 Standard Specification for Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet and Strip.
  - 2. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
  - 3. ASTM B29 Standard Specification for Refined Lead.
  - 4. ASTM B32 Standard Specification for Solder Metal.
  - 5. ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulation.
  - 6. ASTM C208 Standard Specification for Cellulosic Fiber Insulation Board.
  - 7. ASTM C209 Standard Test Method for Cellulosic Fiber Insulating Board.
  - 8. ASTM C272 Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
  - 9. ASTM C1396 Standard Specification for Gypsum Wallboard.
  - 10. ASTM C518 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 11. ASTM C578 Standard Specification for Perlite Thermal Insulation Board.
  - 12. ASTM C728 Standard Test Methods for Fire Test of Roof Coverings.
  - 13. ASTM C1289 Standard Specification for Faced Rigid Polyisocyanurate Thermal Insulation.
  - 14. ASTM D5 Standard Test Method for Penetration of Bituminous Materials.
  - 15. ASTM D36 Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
  - 16. ASTM D312 Standard Specification for Asphalt Used in Roofing.
  - 17. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
  - 18. ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

- 19. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- 20. ASTM D1863 Standard Specification for Mineral Aggregate Used on Built-Up Roofs.
- 21. ASTM D2126 Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.
- 22. ASTM D2178 Standard Specification for Asphalt Glass Felts used in Roofing and Waterproofing.
- 23. ASTM D4601 Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
- 24. ASTM D5147 Standard Sampling and Testing Modified Bituminous Sheet Material.
- B. Cast Iron Soil Pipe Institute, Washington, D.C. (CISPI)
- C. Factory Mutual Research (FM):1. Roof Assembly Classifications.
- D. National Roofing Contractors Association (NRCA):
  1. Roofing and Waterproofing Manual.
- E. Underwriters Laboratories, Inc. (UL):1. Fire Hazard Classifications.
- F. Warnock Hersey (WH):1. Fire Hazard Classifications.
- G. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- H. Steel Deck Institute, St. Louis, Missouri (SDI)
- I. Southern Pine Inspection Bureau, Pensacola, Florida (SPIB)
- J. Insulation Board, Polyisocyanurate (FS HH-I-1972)
- K. Insulation Board, Thermal (Fiberboard) (FS LLL-1-535B)

# 1.4 SUBMITTALS

- A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Division 01 Section Submittal Procedures. 01300.
- B. Provide approval letters from insulation manufacturer for use of their insulation within this particular roofing system type.
- C. Provide a sample of each insulation type.

- D. Shop Drawings
  - 1. Submit manufacturer's shop drawings indicating complete installation details of tapered insulation system, including identification of each insulation block, sequence of installation, layout, drain locations, roof slopes, thicknesses, crickets and saddles.
  - 2. Shop drawing shall include: Outline of roof, location of drains, complete board layout of tapered insulation components, thickness and the average "R" value for the completed insulation system.
- E. Certification
  - 1. Submit roof manufacturer's certification that insulation fasteners furnished are acceptable to roof manufacturer.
  - 2. Submit roof manufacturer's certification that insulation furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

## 1.5 QUALITY ASSURANCE

- A. Fire Classification, ASTM E-108.
- B. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A or B or C] for external fire and meets local or nationally recognized building codes.
- C. Manufacturer's Certificate: Certify that the roof system is adhered properly to meet or exceed the requirements of FM [1-90].
- D. Pre-installation meeting: Refer to Division 07 roofing specifications for pre-installation meeting requirements.

### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.
- B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.
- C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).
- D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

### PART 2 – PRODUCTS

### 2.1 PRODUCTS, GENERAL

- A. Refer to Division 01 Section "Common Product Requirements."
- B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.
- C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.
  - Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
  - 2. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
  - 3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
  - 4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

### 2.2 INSULATION MATERIALS

- 1. Tapered Polyisocyanurate Roof Insulation; ASTM C1289:
  - a. Qualities: Factory Tapered, closed cell polyisocyanurate foam core bonded to heavy duty glass fiber mat facers.
  - b. Thickness: Minimum [ ]
  - c. Average R-Value: Minimum [\_\_]
  - d. Tapered Slope: [\_\_]
  - e. Compliances: UL, WH or FM listed under Roofing Systems Federal Specification HH-I-1972, Class 1
  - f. Acceptable Products:
    - 1) ENRGY 3; Johns Manville
    - 2) EnergyGuard; GAF
    - 3) Approved Equivalent
- 2. Dens-Deck Prime Roof Board
  - a. Qualities: Nonstructural glass mat faced, noncombustible, water-resistant treated gypsum core panel.
  - b. Board Size: Four feet by four feet (4'x4').
  - c. Thickness: One quarter (1/4) inch.
  - d. Thickness: One half (1/2) inch.
  - e. Thickness: Five eighths (5/8) inch.
  - f. R-Value: .28

- g. R-Value: .56
- h. R-Value: .67
- i. Compliances: UL, WH or FM listed under Roofing Systems.
- 2.3 RELATED MATERIALS
  - A. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.
    - 1. Acceptable Manufacturers:
      - a. The Garland Company, Inc.
      - b. Celotex
      - c. Johns Manville
      - d. GAF
      - e. Approved Equivalent
  - B. Protection Board: Densdeck
  - C. Roof Board Joint Tape: Six (6) inches wide glass fiber mat with adhesive compatible with insulation board facers.
  - D. Insulock HR, Or Olybond to adhere Densdeck over fastened insulation
  - E. Fasteners: Corrosion resistant screw fastener as recommended by roof membrane manufacturer.
    - 1. Factory Mutual Tested and Approved with three (3) inches coated disc for I-90 rating, length required to penetrate metal deck one inch.

### PART 3 – EXECUTION

- 3.1 EXECUTION, GENERAL
  - A. Comply with requirements of Division 01 Section "Common Execution Requirements."
- 3.2 INSPECTOR OF SURFACES
  - A. Roofing contractor shall be responsible for preparing an adequate substrate to receive insulation.
    - 1. Verify that work which penetrates roof deck has been completed.
    - 2. Verify that wood nailers are properly and securely installed.
    - 3. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
    - 4. Do not proceed until defects are corrected.
    - 5. Do not apply insulation until substrate is sufficiently dry.
    - 6. Broom clean substrate immediately prior to application.

MODIFIED BITUMINOUS MEMBRANE ROOFING

- 7. Use additional insulation to fill depressions and low spots that would otherwise cause ponding water.
- 8. Verify that temporary roof has been completed.

### 3.3 INSTALLATION

- 1. Approved recovery board one half (1/2) inch thickness shall be installed over base tapered insulation using Insulock HR, or olybond.
- 2. All boards shall be cut and fitted where the roof deck intersects a vertical surface. The boards shall be cut to fit a minimum of one quarter (1/4) inch away from the vertical surface.
- 3. Install no more insulation at one time than can be roofed on the same day.
- 4. Install temporary water cut-offs at completion of each day's work and remove upon resumption of work.
- 5. Cant Strips/Tapered Edge Strips: Install preformed forty five (45) degree cant strip at junctures of vertical surfaces. Provide preformed, tapered edge strips at perimeter of edges of roof that do not terminate at vertical surfaces and/or indicated on the drawings.
- 6. Tape joints of insulation as per manufacturer's requirements.
- A. Attachment with Mechanical Fasteners
  - 1. Approved insulation board shall be fully attached to the deck with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation for FM I-90 system. Otherwise, a minimum of one fastener per two square feet shall be installed.
  - 2. Filler pieces of insulation require at least two fasteners per piece if size of insulation is less than four square feet.
  - 3. Spacing pattern of fasteners shall be as per manufacturer's recommendations to meet the FM requirements. Placement of any fastener from edge of insulation board shall be a minimum of three inches, and a maximum of six (6) inches.
  - 4. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch minimum for metal, wood and structural concrete decks where not specified by the manufacturer. For gypsum and cementwood fiber decks, penetration shall be determined from pull-out test results with a minimum penetration of one and one-half (1 ½) inches.
  - 5. Gypsum and cementitious wood fiber decks: Where the roof deck is visible from the building interior, the contractor shall ensure no penetration of fasteners through underside of the deck. Any holes or spalling caused by fastener installation shall be repaired by the roofing contractor. Where the new roof system thickness exceeds an amount so that a minimum of 1 ½ of penetration cannot be achieved with an Olympic TB Fastener, or approved equivalent, then (and only then) toggle bolts may be used to secure installation to the deck.
  - 6. Tape joints of insulation as per manufacturer's requirements.

# 3.4 CLEANING

A. Remove debris and cartons from roof deck. Leave insulation clean and dry, ready to receive roofing membrane.

# 3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION

### 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. Sheet Metal Flashing/Counterflashing.
  - 2. Sheet Metal Trim.
- B. Related Sections:
  - 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated 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. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

QUALITY ASSURANCE

- C. Fabricator Qualifications: Shop that 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.
- D. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

## 1.5 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. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

## PART 2 - PRODUCTS

# 2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
  - 1. Surface: Smooth, flat.
  - 2. Exposed Coil-Coated Finishes:
    - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent 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.
  - 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 a minimum total dry film thickness of 0.5 mil (0.013 mm).
- C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
  - 2. Surface: Smooth, flat.
  - 3. Exposed Coil-Coated Finish:

- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent 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.
- 4. Color: As selected by Architect from manufacturer's full range.
- 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 a minimum total dry film thickness of 0.5 mil (0.013 mm).

## 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item 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 or manufactured item.
  - 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.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
  - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

### 2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry,

metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

- 1. 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.
- 2. Obtain field measurements for accurate fit before shop fabrication.
- 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
- 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Seams: 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.
- I. Do not use graphite pencils to mark metal surfaces.

### PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of 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.

- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
  - 5. Install sealant tape where indicated.
  - 6. Torch cutting of sheet metal flashing and trim is not permitted.
  - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
  - 1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws, metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal joints as shown and as required for watertight construction.
  - Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
  - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

### 3.3 FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, interlocking folded seam or blind rivets and sealant.

### 3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following manufactured roof specialties:
  - 1. Copings.
  - 2. Counterflashings and reglets.
- B. Related Sections include the following:
  - 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 07 Section "Manufactured Roof Expansion Joints" for expansion joint cover assemblies.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. FMG Listing: Manufacture and install copings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-90. Identify materials with FMG markings.
- C. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

#### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
  - 1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
  - 2. Details for expansion and contraction.

## 1.5 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

## 1.6 COORDINATION

A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

### 1.7 WARRANTY

- A. Special Warranty on Painted Finish: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - 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 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
  - 1. Surface: Smooth, flat finish.
  - 2. High Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instruction.
    - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color

topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

### 2.2 CONCEALED METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.
- B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

### 2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
  - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
- C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- D. Elastomeric Sealant: ASTM C 920, 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. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- G. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
- H. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

#### 2.4 COPINGS

- A. Copings: Manufactured system consisting of clamp on extruded fascia in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as fascia, mitered corner units, and end cap units.
  - 1. Available Manufactuers:
    - a. Architectural Products Co.

- b. ATAS International, Inc.
- c. Firestone Building Products
- d. Hickman, W. P. Company.
- e. Merchant & Evans, Inc.
- f. MM Systems Corporation.
- g. Perimeter Systems, a division of Southern Aluminum Finishing Co.
- h. Petersen Aluminum Corp.
- 2. Coping Caps: Fluoropolymer coated Aluminum: 0.040 inch (1.0 mm) thick).
- 3. Color: As selected by Architect from manufacturer's full range of standard finishes.
- 4. Corners: Mechanically clinched and sealed watertight.
- 5. Face Leg Cleats: Concealed, continuous galvanized steel sheet.

### 2.5 COUNTERFLASHINGS AND REGLETS

- A. Manufacturers:
  - 1. Cheney Flashing Company.
  - 2. Fry Reglet Corporation.
  - 3. Hickman, W. P. Company.
  - 4. Keystone Flashing Company.
  - 5. Merchant & Evans, Inc.
  - 6. Metal-Era, Inc.
  - 7. MM Systems Corporation.
- B. Counterflashings: Manufactured units in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated:
  - 1. Fluoropolymer Coated Aluminum: 0.032 inch (0.8 mm) thick.
- C. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated with factory-mitered and welded corners and junctions, from the following exposed metal in thickness indicated:
  - 1. Fluoropolymer Coated Aluminum: 0.050 inch (1.2 mm) thick.
- D. Accessories: Counterflashing wind-restraint clips.

### 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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
  - 1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
  - 1. Install manufactured roof specialties with provisions for thermal and structural movement.
  - 2. Torch cutting of manufactured roof specialties is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.

- F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- G. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

## 3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to resist uplift and outward forces according to performance requirements.

## 3.4 COUNTERFLASHING AND REGLET INSTALLATION

- A. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings 4 inches (100 mm) over base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
- 3.5 CLEANING AND PROTECTION
  - A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
  - B. Clean and neutralize flux materials. Clean off excess solder and sealants.
  - C. Remove temporary protective coverings and strippable films as manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
  - D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Roof hatches.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for metal ladders to roof hatches.
  - 2. Division 07 low-slope roofing Sections for roofing accessories.
  - 3. Division 07 Section "Roof Specialties" for fascia, copings, and gravel stops.

#### 1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

#### 1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

## 1.6 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

#### 2.2 METAL MATERIALS

- A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
  - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 (Class AZM150) coated.
  - 3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
    - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2604, AAMA 2605, except as modified below:
      - 1) Humidity Resistance: 1000 hours.
      - 2) Salt-Spray Resistance: 1000 hours.
- B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- C. Steel Tube: ASTM A 500, round tube, baked-enamel finished.
- D. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- E. Galvanized Steel Pipe: ASTM A 53/A 53M.

#### 2.3 MISCELLANEOUS MATERIALS

- A. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch (25 mm) thick.
- B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

## 2.4 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated single, double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
  - 1. Manufacturers:
    - a. Babcock-Davis; a Cierra Products Inc. Company.
    - b. Bilco Company (The).
    - c. Bristolite Skylights.
    - d. Custom Curb, Inc.
    - e. Dur-Red Products.
    - f. Hi Pro International, Inc.
    - g. J. L. Industries, Inc.
    - h. Metallic Products Corporation.
    - i. Milcor Inc.; a Gibraltar Company.
    - j. Nystrom, Inc.
    - k. O'Keeffe's Inc.
    - I. Precision Ladders, LLC.
    - m. Roof Products & Systems Corporation.
    - n. ThyCurb; Div of Thybar Corporation.
    - o. Wasco Products, Inc.
    - p. Western Canwell.
  - 2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. (1.9-kPa) external and 20-lbf/sq. ft. (0.95-kPa) internal loads.
  - 3. Type and Size: Single-leaf lid, 30 by 36 inches.
  - 4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch (2.0 mm) thick.
    - a. Finish: High-performance organic coating.
  - 5. Insulation: Polyisocyanurate board.
  - 6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
  - 7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
  - 8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
  - 9. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.
  - 10. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
  - 11. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.
    - a. Height: 42 inches (1060 mm) above finished roof deck.
    - b. Material and Finish: Steel tube, baked enameled.

c. Diameter: Pipe with 1-5/8-inch (41-mm) OD tube.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
  - 2. Verify dimensions of roof openings for roof accessories.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum, stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
  - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
  - 2. Attach ladder safety post according to manufacturer's written instructions.
- F. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

### 3.3 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

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END OF SECTION 077200

## SECTION 077616 - ROOF DECKING PAVER SYSTEM

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Furnish and install a complete architectural pavers and adjustable pedestal deck support system.
- B. Section Includes:
  - 1. Architectural pavers.
  - 2. Adjustable pedestal supports.
  - 3. Accessories.
- C. Related Requirements:
  - 1. Division 7 Section PVC Roofing.

### 1.3 DEFINITIONS

A. Finish Elevation: Elevation of finished paver system.

#### 1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.5 ACTION SUBMITTALS

- A. Product Data:
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
  - 1. Include plans, sections, slopes, and drain locations.
  - 2. Indicate dimensions, weights, and loads.
  - 3. Detail field assembly of components and attachments to other work.
  - 4. Indicate architectural pavers and accessories.
- C. Samples for Verification: For each of the following components of vegetated roof assembly:

- 1. Architectural Paver, full size, manufacturer's standard size, in each color and texture required; include installation accessories to illustrate assembly.
- 2. Adjustable pedestal full size unit.
- 1.6 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.
  - B. Product Certificates: For each type of manufactured product.
    - 1. Manufacturer's certified analysis of standard products.
  - C. Field quality-control reports.
  - D. Sample Warranty: For special warranties.

### 1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roof decking paver system, including a recommended maintenance plan with procedures for inspection and care during a calendar year. Submit before start of required warranty and maintenance periods.

### 1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified roof decking paver system Installer, approved, authorized, or licensed by roofing-membrane manufacturer.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and Federal laws if applicable.
- B. Handle and store materials, and place equipment in a manner to avoid overloading roof structure or damaging roofing membrane.

### 1.10 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of roof decking paver system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain architectural pavers and components from single source from single manufacturer.
- B. Basis of Design: Provide Classic Plaza Pavers and Screw Jack pedestals as manufactured by Westile, an Old Castle Company, or equivalent system by:
  - 1. Tile Tech Inc.
  - 2. Hanover Architectural Products,
  - 3. Unilock
  - 4. County Materials Corporation
  - 5. AWS

### 2.2 ARCHITECTURAL PAVERS

- A. Heavyweight Concrete Walkway Pavers: Heavyweight, hydraulically pressed, concrete units, with top edges beveled 3/16 inch (5 mm), manufactured for use as roof- or plaza-deck pavers; with absorption not greater than 5 percent according to ASTM C 140; with no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.
  - 1. Thickness: 1-7/8 inches.
  - 2. Face Size: 24 inches (610 mm) square.
  - 3. Weight: 23 lb/sq. ft..
  - 4. Compressive Strength: 9000 psi minimum when tested according to ASTM C 140.
  - 5. Color: As selected by Architect from manufacturer's full range.
- B. Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including adjustable or stackable pedestals, shims, and spacer tabs for joint spacing of 1/8 inch (3 mm).

#### 2.3 ACCESSORIES

A. Protection Board: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners; 1/4-inch (6-mm) nominal thickness As recommended by roofing-membrane manufacturer.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine each area to receive roof decking paver system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify that roof insulation over roofing membrane is in place, secure, and flush along all seams.
  - 2. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by vegetated roof assembly.

## 3.2 INSTALLATION, GENERAL

- A. Protection: Protect adjacent roofing system with protection board prior to installation.
- B. Install roof decking paver system according to manufacturer's written instructions.

#### 3.3 ARCHITECTURAL-PAVER INSTALLATION

- A. Installation: Install pavers according to manufacturer's written instructions.
- B. Install paver supports according to pedestal manufacturer's written instructions. Adjust for final level and slope with shims.
- C. Loosely set walkway pavers, maintaining a uniform joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
  - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

## 3.4 PERIMETER CONTAINMENT

A. Any area of the pedestal deck that is not restrained by a parapet or structural wall must be "boxed-in" and contained. The deck panels will move if all sides are not adequately restrained. Perimeter framing and edging boards located at the outside of the deck perimeter must be installed to provide restraint. No movement should be allowed at the perimeter of the deck system greater than one tab width.

### 3.5 FIELD QUALITY CONTROL

- A. Inspect often during installation to assure that grid spacer lines are being maintained in a straight and consistent pattern and that deck pavers or tiles are level and not rocking. Unless otherwise specified in writing to allow for expansion, inspect to assure that all paver spacing between tiles and at perimeter walls does not exceed a tabl width. Particular attention should be made to assure that all pedestrian entry or access points to the deck are level and that the deck surface tiles are not randomly raised or uneven creating a tripping or safety hazard.
- B. Confirm that deck pedestal height excess of sixteen (16) inches have been braced in accordance with manufacturer's written instructions.
- C. Manufacturer's Field Service: Engage roofing-membrane manufacturer's authorized service representative to provide inspection of roof decking paver system installation and prepare inspection reports.
- D. Correct deficiencies in work that do not comply with requirements.
- E. Prepare test and inspection reports.

# 3.6 PROTECTION

A. Protect from damage due to operations of other contractors and trades. Repair or replace damaged components.

## 3.7 MAINTENANCE SERVICE

- A. Perform routine maintenance of the deck. Check the rocking pavers and adjust. Pedestals can settle and may have to be realigned. Failure to do so can cause a tripping hazard. Periodically check spacer tabs and immediately replace.
  - 1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 077616

## SECTION 078413 - PENETRATION FIRESTOPPING

### 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 through-penetration firestop systems for penetrations through fireresistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
  - 1. Division 07 Section "Fire-Resistive Joint Systems."
  - 2. Division 21 Sections specifying fire-suppression piping penetrations.
  - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
  - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:
  - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
  - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
  - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moistureresistant through-penetration firestop systems.
  - 2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

- 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

## 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
  - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
  - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
  - 1. Types of penetrating items.
  - 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
  - 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- D. Qualification Data: For Installer.
- E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
  - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
  - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
    - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

## 1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined byArchitect and building inspector, if required by authorities having jurisdiction.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems.
  - 1. Hilti, Inc. materials must be red and pink in color.

### 2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-/rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
  - 2. Temporary forming materials.
  - 3. Substrate primers.
  - 4. Collars.
  - 5. Steel sleeves.

#### 2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
  - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
  - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

## 2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

## 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type

with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted.

# 3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

# SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes fire-resistive joint systems for the following:
  - 1. Floor-to-wall joints.
  - 2. Head-of-wall joints.
  - 3. Wall-to-wall joints.
- B. Related Sections include the following:
  - 1. Division 07 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
  - 2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.

## 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.
- B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities and L-ratings indicated as determined by UL 2079.
- C. For fire-resistive systems exposed to view, provide products with flame-spread and smokedeveloped indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fireresistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

- 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- D. Qualification Data: For Installer.
- E. Field quality-control test reports.
- F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
- G. Research/Evaluation Reports: For each type of fire-resistive joint system.

## 1.5 QUALITY ASSURANCE

- A. Installation Responsibility: Assign installation of through-penetration firestop systems and fireresistive joint systems in Project to a single qualified installer.
- B. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

# 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

# 1.8 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- Do not cover up fire-resistive joint system installations that will become concealed behind other D. construction until Owner's inspecting agency and building inspector of authorities having jurisdiction have examined each installation.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- Products: Subject to compliance with requirements, provide one of the fire-resistive joint Α. systems indicated for each application in the Fire-Resistive Joint System Schedule at the end of Part 3. 1.
  - Hilti, Inc.

#### 2.2 FIRE-RESISTIVE JOINT SYSTEMS

- Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, Α. under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- Accessories: Provide components of fire-resistive joint systems, including primers and forming Β. materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

# PART 3 - EXECUTION

#### 3.1 **EXAMINATION**

- Examine substrates and conditions, with Installer present, for compliance with requirements for Α. joint configurations, substrates, and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to Α. comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - Remove from surfaces of joint substrates foreign materials that could interfere with 1. adhesion of fill materials.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.

- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

## 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
  - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

# 3.4 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fireresistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fireresistive joint systems complying with specified requirements.

## 3.5 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" are indicated on drawings.

END OF SECTION 078446

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. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints in unit masonry.
    - b. Joints in exterior insulation and finish systems.
    - c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    - d. Other joints as indicated.
  - 2. Exterior joints in the following horizontal traffic surfaces:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Perimeter joints of exterior openings where indicated.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of walls and partitions.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - f. Other joints as indicated.
  - 4. Interior joints in the following horizontal traffic surfaces:
    - a. Control and expansion joints in flooring.
    - b. Other joints as indicated.
- B. Related Sections include the following:
  - 1. Division 08 Section "Glazing" for glazing sealants.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and waterresistant continuous joint seals without staining or deteriorating joint substrates.

## 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
  - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- H. Field Test Report Log: For each elastomeric sealant application.
- I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
- J. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

- 1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
- 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36month period preceding the commencement of the Work.
  - 1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- E. Preconstruction Field-Adhesion Testing: Before installing elastomeric 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 application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
  - 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 in ASTM C 1193.
      - 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 in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type 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.

## 1.6 PROJECT 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 jointsealant manufacturer or are below 40 deg F (5 deg C).
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those 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 elastomeric joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
  - 2. Disintegration of joint substrates from natural 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 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

## 2.2 MATERIALS, 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:
  - 1. Products:
    - a. Dow Corning Corporation; 786 Mildew Resistant.
    - b. GE Silicones; Sanitary SCS1700.
    - c. Tremco; Tremsil 200.
  - 2. Type and Grade: S (single component) and NS (nonsag).
  - 3. Class: 25.
  - 4. Use Related to Exposure: NT (nontraffic).
- D. Multicomponent Nonsag Urethane Sealant:
  - 1. Products:
    - a. Sika Corporation, Inc.; Sikaflex 2c NS TG.
    - b. Sonneborn, Division of ChemRex Inc.; NP 2.
    - c. Tremco; Vulkem 227.
    - d. Tremco; Vulkem 322 DS.
    - e. Pecora Corporation; Dynatrol II.
    - f. Tremco; Dymeric.
  - 2. Type and Grade: M (multicomponent) and NS (nonsag).
  - 3. Uses Related to Exposure: T (traffic) and NT (nontraffic).
- E. Multicomponent Pourable Urethane Sealant:
  - 1. Products:
    - a. Meadows, W. R., Inc.; POURTHANE.
    - b. Pecora Corporation; Urexpan NR-200.
    - c. Tremco; THC-901.
    - d. Tremco; THC-900.
    - e. Tremco; Vulkem 245.
    - f. Pecora Corporation; Urexpan NR 300.
  - 2. Type and Grade: M (multicomponent) and P (pourable).
  - 3. Class: 25.
  - 4. Use Related to Exposure: T (traffic).

## 2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.
- B. Products:
  - 1. Bostik Findley; Chem-Calk 600.
  - 2. Pecora Corporation; AC-20+.
  - 3. Schnee-Morehead, Inc.; SM 8200.
  - 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
  - 5. Tremco; Tremflex 834.

## 2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:
  - 1. Products:
    - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
    - b. illbruck Sealant Systems, Inc.; Wilseal 600.
    - c. Polytite Manufacturing Corporation; Polytite B.
    - d. Sandell Manufacturing Co., Inc.; Polyseal.
  - 2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

## 2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

# 2.7 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 joint-sealant performance.
- 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. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 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 C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type 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 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

## 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 exterior elastomeric sealant joints as follows:
    - a. Perform 1 test for each 500 feet of joint length.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab in Appendix X1 in ASTM C 1193, as appropriate for type of joint-sealant application indicated.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
  - 4. Inspect tested joints and report on the following:
    - a. 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
    - b. Whether sealants filled joint cavities and are free of voids.
    - c. Whether sealant dimensions and configurations comply with specified requirements.
  - 5. 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 fill, sealant configuration, and sealant dimensions.
  - 6. 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 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 and remove 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 vertical and horizontal nontraffic construction joints in castin-place concrete.
  - 1. Joint Sealant: Multicomponent nonsag urethane sealnt.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- B. Joint-Sealant Application: Exterior horizontal nontraffic and traffic isolation and contractionjoints in cast-in-place concrete slabs.
  - 1. Joint Sealant: Multicomponent pourable urethane sealant.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- C. Joint-Sealant Application: Exterior joints in unit masonry.
  - 1. Joint Sealant: Multicomponent nonsag polysulfide sealant.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- D. Joint-Sealant Application: Exterior perimeter joints between frames of doors, windows, and louvers.
  - 1. Joint Sealant: Multicomponent nonsag urethane sealant.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- E. Joint-Sealant Application: Exterior joints in exterior insulation and finish system.
  - 1. Joint Sealant: Multicomponent nonsag urethane sealant.
  - 2. Joint Sealant Color: As selected by Architect from manufacturer's full range.
- F. Joint-Sealant Application: Interior perimeter joints of exterior openings.
  - 1. Joint Sealant: Latex sealant.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- G. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
  - 1. Joint Sealant: Single-component mildew-resistant silicone sealant
- H. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
  - 1. Joint Sealant: Latex sealant.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

SECTION 079500 - EXPANSION CONTROL

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior expansion control systems.
  - 2. Exterior wall expansion control systems.

### 1.2 ACTION SUBMITTALS

- A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams.
- B. Samples: For each exposed expansion control system and for each color and texture specified.

## PART 2 - PRODUCTS

## 2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
  - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
  - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.
- B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

- 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
- 2. Component Importance Factor is 1.0.

# 2.3 INTERIOR EXPANSION CONTROL SYSTEMS

- A. Available Manufacturers:
  - 1. Balco, Inc.
  - 2. Construction Specialties
  - 3. M-M. Systems Corporation.
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Wall-to-Wall, Wall-to-Corner for use in CMU walls:
  - 1. Basis-of-Design Product: Construction Specialties Models FWF-200M FWFC-200M.
  - 2. Design Criteria:
    - a. Nominal Joint Width: 2 inches.
    - b. Minimum Joint Width: 1 inch.
    - c. Maximum Joint Width: 2.5 inches.
    - d. Type of Movement: As indicated on Drawings.
  - 3. Type: Elastomeric seal.
    - a. Metal: Aluminum.
      - 1) Finish: Mill.
    - b. Seal Material: Manufacturer's standard.
      - 1) Color: As selected by Architect from manufacturer's full range.
- D. Wall-to-Wall for use in gypsum board Walls/Ceilings:
  - 1. Basis-of-Design Product: Construction Specialties Model FWS 200.
  - 2. Design Criteria:
    - a. Nominal Joint Width: 2 inches.
    - b. Minimum Joint Width: 1.25 inches.
    - c. Maximum Joint Width: 4 inches.
    - d. Type of Movement: As indicated on Drawings.
  - 3. Type: Accordion.
    - a. Metal: Aluminum.
      - 1) Finish: Mill.
    - b. Seal Material: Manufacturer's standard.

- 1) Color: As selected by Architect from manufacturer's full range.
- E. Ceiling-to-Ceiling for use at acoustical ceilings:
  - 1. Basis-of-Design Product: Construction Specialties Model HC-200.
  - 2. Design Criteria:
    - a. Nominal Joint Width: 2 inches.
    - b. Minimum Joint Width: 0 inches.
    - c. Maximum Joint Width: 4 inches.
    - d. Type of Movement: As indicated on Drawings.
  - 3. Type: Accordion, Flat seal.
    - a. Unit attaches to suspended ceiling system drop tees.
    - b. Seal Material: Manufacturer's standard.
      - 1) Color: White.

# 2.4 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Available Manufacturers:
  - 1. Balco, Inc.
  - 2. Construction Specialties
  - 3. M-M Systems Corporation
- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.
- C. Wall-to-Wall and Wall-to-Corner:
  - 1. Basis-of-Design Product: Construction Specialties SF-200 & SF200C (Corner).
  - 2. Design Criteria:
    - a. Nominal Joint Width: 2 inches.
    - b. Minimum Joint Width: 1.25 inches.
    - c. Maximum Joint Width: 3 inches.
    - d. Type of Movement: As indicated on Drawings.
  - 3. Type: Flat seal.
    - a. Metal: Aluminum.
    - b. Seal Material: Manufacturer's standard.
      - 1) Primary Seal: Santoprene.

Color: As selected by Architect from manufacturer's full range.

2) Secondary Seal: PVC.

## 2.5 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover. Equip moisture barrier with drain tubes and seals to direct collected moisture to exterior-wall expansion control system.

### 2.6 MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.
  - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Compression Seals: ASTM E 1612; preformed elastomeric extrusions having an internal baffle system and designed to function under compression.
- D. Fire Barriers: Any material or material combination to meet performance criteria for required fireresistance rating.
- E. Moisture Barrier: Flexible elastomeric material.
- F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M.
- G. Accessories: Manufacturer's standard anchors, clips, fasteners, and other accessories as indicated or required for complete installations.

## 2.7 ALUMINUM FINISHES

A. Mill finish.

## PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems.

#### 3.2 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
  - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
  - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
  - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
  - 4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
  - 5. Install frames in continuous contact with adjacent surfaces.
    - a. Shimming is not permitted.
  - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.
- C. Seals in Metal Frames: 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 according to manufacturer's written instructions. 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.
- D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.
- E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
  - 1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- F. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings.

## 3.3 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete.
- B. Protect the installation from damage by work of other Sections.

## END OF SECTION 079500

# 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. Standard hollow metal doors and frames
- B. Related Sections:
  - 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
  - 2. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

## 1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

## 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 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.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 7. Details of accessories.
  - 8. Details of moldings, removable stops, and glazing.
- C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
  - C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
    - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## 1.7 COORDINATION

A. Coordinate installation of anchorages 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.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amweld Building Products, LLC.
  - 2. Benchmark; a division of Therma-Tru Corporation.
  - 3. Ceco Door Products; an Assa Abloy Group company.
  - 4. Curries Company; an Assa Abloy Group company.
  - 5. Deansteel Manufacturing Company, Inc.
  - 6. Firedoor Corporation.
  - 7. Mesker Door Inc.
  - 8. Pioneer Industries, Inc.
  - 9. Steelcraft; an Ingersoll-Rand company.
- 2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

# 2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-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.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Glazing: Comply with requirements in Division 08 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.4 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

- a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
  - 1) Locations: Exterior doors.
- 3. Fire Door Cores: As required to provide fire-protection and temperature rise ratings indicated.
- 4. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
- 5. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
- 6. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
- 7. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Level 4 and Physical Performance Level A (Maximum Duty), Model 1 (Full Flush).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

# 2.5 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as full profile welded unless otherwise indicated.
  - 3. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet. (.053-inch thick if less than 4'-0" wide).
- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as full profile welded unless otherwise indicated.
  - 3. Frames for Level 3 Steel Doors: 0.067-inch- (1.7-mm-) thick steel sheet. (.053-inch thick if less than 4'-0" wide).
  - 4. Frames for Borrowed Lights: Same as adjacent door frame.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

# 2.6 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
  - 2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

# 2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

## 2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 2.9 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. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:

- 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- 2. Glazed Lites: Factory cut openings in doors.
- 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
    - b. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  - 6. Door Silencers: Except on weather-stripped doors, 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.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 4. Provide loose stops and moldings on inside of hollow metal work.
  - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

# 2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 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.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

- 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

# 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. 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, leaving surfaces smooth and undamaged.
    - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - b. Install frames with removable glazing stops located on secure side of opening.
    - c. Install door silencers in frames before grouting.
    - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
    - g. At fire rated openings, install frames according to NFPA 80.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

- d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

## 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

# SECTION 081416 - FLUSH WOOD DOORS

### 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. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
  - 1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

## 1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
- E. Warranty: Sample of special warranty.
- 1.4 QUALITY ASSURANCE

- A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
  - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

# 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067by-2134-mm) section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.
  - 3. Marshfield Door Systems, Inc.
  - 4. VT Industries Inc.
# 2.2 DOOR CONSTRUCTION, GENERAL

- A. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf (3100 N).
    - b. Screw Withdrawal, Edge: 400 lbf (1780 N).
- B. Mineral-Core Doors:
  - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware. as follows:
    - a. 5-inch (125-mm) top-rail blocking.
    - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
    - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
    - d. 4-1/2-by-10-inch (114-by-250-mm) lock blocks, 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
  - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

# 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
  - 1. Grade: Premium, with Grade A faces.
  - 2. Species: Select White Oak.
  - 3. Cut: Plain sliced (flat sliced).
  - 4. Match between Veneer Leaves: Book match.
  - 5. Assembly of Veneer Leaves on Door Faces: Running match.
  - 6. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
  - 7. Exposed Vertical and Top Edges: Same species as faces.
  - 8. Core: Either glued wood stave or structural composite lumber.
  - 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
  - 10. Performance Grade: Heavy Duty.

# 2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

- C. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

# 2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory.
- C. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: AWI conversion varnish or catalyzed polyurethane system.
  - 3. Staining: As selected by Architect from manufacturer's full range of transparent finish options.
  - 4. Effect: Filled finish.
  - 5. Sheen: Satin.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for firerated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

- 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
- 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

# 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

# SECTION 083113 - ACCESS 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. This Section includes the following:
  - 1. Access doors and frames for walls and ceilings.
- B. Related Sections include the following:
  - 1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
  - 2. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

# 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

## 1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

# 2.1 STEEL MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
- B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
    - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
  - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- C. Fire-Rated, Flush Access Doors with Exposed Flanges:
  - 1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard width exposed flange, proportional to door size.
  - 2. Locations: Wall and ceiling.
  - 3. Fire Resistance Rating: Not less than that of adjacent construction.
  - 4. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage.
    a. Finish: Factory prime.
  - Metallic Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm) 20 gage.
     a. Finish: Factory prime, factory finish.
  - 6. Frame: Material: Same material, thickness and finish as door.
  - 7. Hinges: Manufacturer's standard.
  - 8. Hardware: Latch.

# 2.2 ACESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acudor Products, Inc.
  - 2. Babcock-Davis; A Cierra Products Co.
  - 3. Bar-Co, Inc. Div.; Alfab, Inc.
  - 4. Cendrex Inc.
  - 5. Dur-Red Products.
  - 6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
  - 7. Jensen Industries.
  - 8. J. L. Industries, Inc.
  - 9. Karp Associates, Inc.
  - 10. Larsen's Manufacturing Company.
  - 11. MIFAB, Inc.

- 12. Milcor Inc.
- 13. Nystrom, Inc.
- 14. Williams Bros. Corporation of America (The).
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from metallic-coated steel sheet.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
  - 3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-1/4-inch- (32-mm-) wide, surface-mounted trim.
  - 4. Hinges: Spring-loaded, concealed-pin type.
  - 5. Latch and lock: Latch bolt, key operated. Prepared for mortise cylinder.

# 2.3 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 attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  - 1. Exposed Flanges: As indicated, Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
  - 2. Provide mounting holes in frames for attachment of units to metal or wood framing.
  - 3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

# PART 3 - EXECUTION

# 3.1 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 finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- 3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083300 - TORNADO COILING DOORS

PART 1 GENERAL

- 1.01 GENERAL REQUIREMENTS
  - A. Provide all materials, labor, equipment and services necessary to furnish, deliver and install all work under this section as shown on the contract documents, specified herein, and as specified by the job conditions.

#### 1.02 DESCRIPTION

- A. Related work specified elsewhere:

  - 1. Metal Fabrication.Section 05 50 002. Rough Carpentry.Section 06 10 00
  - 3. Access Panels & Doors: Section 08 31 00
  - 4. Painting: Section 09 91 00
  - 5. Electrical: Division 26

#### 1.03 SUBMITTALS

- A. Procedures: Furnish submittals in accordance with the general requirements specified.
- B. Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each coiling acoustically rated service door.
- C. Certifications:
  - 1. Provide certification from an accredited testing laboratory of product compliance with FEMA 361 Safe Rooms for Tornadoes and Hurricanes.
  - 2. Provide certification from an accredited testing laboratory of product compliance with ICC 500 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
  - 3. Provide certification form accredited testing laboratory of product compliance to sustain a 240 psf wind pressure (1.2 times the design wind pressure of 200 psf) in accordance with ASTM E330.
  - 4. Provide certification form accredited testing laboratory of product compliance in accordance with the requirements of ASTM E1886 Large Missile Impact for FEMA 361 assemblies.
- D. Product Literature: Submit manufacturer's technical literature describing the product to be used under this section.
- E. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all tornado and hurricane resistant coiling doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

#### 1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable FEMA requirements as well as laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.
- B. Manufacturer Requirements: Manufacturer shall have been in the business of and have experience in manufacturing wide span opening protective door assemblies as well as providing dependable credible service for a minimum of ten (10) years.

# 1.05 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.
- 1.06 WARRANTY
  - A. Tornado and Hurricane Resistant Coiling Door Warranty: Furnish one (1) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

### PART 2 PRODUCTS

- 2.01 TORNADO AND HURRICANE RESISTANT COILING DOORS
  - A. Manufacturer: Tornado and hurricane resistant coiling doors shall be the model SafeSpace 500-G as manufactured by McKeon Door Company. Door assembly shall be tested and certified by an accredited testing laboratory, approved for use in FEMA 361 and ICC 500 safe rooms and storm shelters, or equal product by:
    - 1. Alpine Doors, Inc.
    - 2. Cornell Cookson, LLC

# 2.02 MATERIALS

- A. Curtain: Shall be assembled of interlocking galvanized steel slats. Curtain shall be formed of ID slat profile sections with a polymeric insulation core of gauge as required to sustain the minimum required design wind pressure. Slat cross section shall not be less than 3" wide by 1-1/2" deep.
- B. Bottom Bar: Shall consist of a double structural steel angle assembly formed to fit and engage the curtain assembly.
- C. Guides Each guide assembly shall be fabricated of structural steel support angles and guide retaining angles of a sufficient depth to retain curtain in the guides under the design wind pressure and impact forces specified.
- D. Mounting Brackets: Fabricated of hot rolled 3/16" minimum steel plates, brackets shall be provided to house ends of the counterbalance barrel assembly.
- E. Hood: Shall be provided to entirely enclose coiled curtain and counterbalance barrel assembly. Hood shall be fabricated 22 gauge galvanized steel, designed and formed to match brackets. Top and bottom shall be bent and reinforced to provide for proper stiffness.
- F. Counterbalance Assembly: Coiling door shall be counterbalanced by means of adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks or rings for attachment of curtain. Grease sealed bearings or self-lubricating graphite bearings shall be attached to the spring barrel which shall be fabricated of hot formed structural quality carbon steel seamless pipe.
- G. Electric Motor Operator: Coiling door shall be provided with a compact power unit designed and built by the coiling door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency gearing running in an oil

bath, shall be furnished together with a magnetic operated brake, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.

- 1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation. Horsepower of motor is to be 1/3hp minimum or of manufacturer's recommended size, which ever is greater.
- 2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.
- 3. Reducer: Spiral gear type, 70% efficiency minimum.
- 4. Brake: Magnetically activated, integral within the operator's housing.
- 5. Control Station: Provide surface mount push button control station marked open, close and stop.
- H. Obstruction Sensing Device: The coiling door shall be designed with an obstruction sensing safety edge. In the event that the safety edge meets an obstruction during the normal closing operation, the coiling door shall stop, reverse and return to the open position.
- I. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Curtain assembly is to receive a prime coat finish of .2 mils of epoxy primer and .8 mils of polyester paint in a McKeon Sterling Gray finish.

# PART 3 EXECUTION

# 3.01 EXAMINATION

- A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.
- B. Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.
- C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

# 3.02 INSTALLATION

- A. Perform installation using only factory approved and certified representatives of the coiling door manufacturer.
- B. Install coiling door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.
- C. Adjust coiling acoustically rated service door installation to provide uniform clearances and smooth non-binding operation.
- D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.

# 3.03 PROTECTION AND CLEANING

A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.

- B. Remove, repair or replace materials which have been damaged in any way.
- C. Clean surfaces of grime and dirt using acceptable and recommended means and methods.

END OF SECTION 083300

SECTION 083313 - COILING COUNTER DOORS

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. Counter doors.
- B. Related Sections:
  - 1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

### 1.3 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
  - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
  - 1. Include similar Samples of accessories involving color selection.

# 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

# PART 2 - PRODUCTS

#### 2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated.
- B. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

### 2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

#### 2.3 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

#### 2.4 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

# 2.5 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall

thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

# 2.6 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).

# 2.7 DOOR ASSEMBLY

- A. Counter Door: Overhead coiling door formed with curtain of interlocking metal slats.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Model ESC10 by Cornell Iron Works, Inc. or comparable product by one of the following:
    - a. Cornell Iron Works, Inc.
    - b. Cookson Company
    - c. Overhead Door Corporation.
    - d. Raynor.
    - e. Southwestern Steel Rolling Door Co.
    - f. Wayne-Dalton Corp.
    - g. Windsor Door.
- B. Operation Cycles: Not less than 10,000.
- C. Door Curtain Material: Stainless steel.
- D. Door Curtain Slats: Flat profile slats.
- E. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.
- F. Hood: Match curtain material and finish.
  - 1. Shape: Round.
  - 2. Mounting: Face of wall.
- G. Locking Devices: Equip door with slide bolt for padlock
  - 1. Locking Device Assembly: locking bars, operable from inside.

- H. Manual Door Operator: Push-up operation.
- I. Door Finish: Stainless Steel, no. 4 polished directional satin

# 2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# 2.9 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

#### 3.3 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

# 3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083313

# SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Exterior and interior manual-swing entrance doors.
  - 2. Storefront systems.
  - 3. Sunshades.

#### 1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

# 1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
  - 1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
  - 2. Dimensional tolerances of building frame and other adjacent construction.
  - 3. Failure includes the following:
    - a. Deflection exceeding specified limits.
    - b. Thermal stresses transferring to building structure.
    - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    - d. Noise or vibration created by wind and by thermal and structural movements.
    - e. Loosening or weakening of fasteners, attachments, and other components.
    - f. Sealant failure.
    - g. Failure of operating units.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.

- 2. Seismic Loads: As indicated on Drawings.
- C. Deflection of Framing Members:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not fewer than 60 seconds.
- E. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) when tested according to AAMA 1503.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- E. Other Action Submittals:
  - 1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Qualification Data: For qualified Installer.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- I. Warranties: Sample of special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
  - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code Aluminum."

# 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

# 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Adhesive or cohesive sealant failures.
    - e. Water leakage through fixed glazing and framing areas.
    - f. Failure of operating components.
  - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Tri-Fab 451T Storefront Window System with Series 350 Medium Stile Entrance Doors and Versoleil Sunshade by Kawneer or comparable product by one of the following:
  - 1. EFCO Corporation.
  - 2. Kawneer North America; an Alcoa company.
  - 3. Tubelite.
  - 4. United States Aluminum.
  - 5. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

#### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
  - 4. Structural Profiles: ASTM B 308/B 308M.
  - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

#### 2.3 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

# 2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
  - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

- 2. Door Design: Wide stile; 5-1/2-inch nominal width, 6-1/2" high bottom rail.
- 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
  - a. Provide nonremovable glazing stops on outside of door.
- B. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware".
- C. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
- D. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
  - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- F. Silencers: BHMA A156.16, Grade 1.
- G. Thresholds: BHMA A 156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of ½ inch (12.7 mm). Provide Hager 431S, mill finish aluminum.
- 2.5 SUN CONTROL
  - A. Sunshades: Assemblies consisting of manufacturer's standard outrigger brackets, louvers, and fascia, designed for attachment to curtain wall with mechanical fasteners.
    - 1. Orientation: Horizontal.
    - 2. Projection from Wall: 30 inches (762 mm).
    - 3. Outriggers: Straight with square edges.
    - 4. Louvers:
      - a. Number: Four louvers per unit.
      - b. Shape: Planar.
      - c. Width: 5 inches.
      - d. Mounting Angle: 35 degrees.
    - 5. Fasciae: Rectangular.
    - 6. Finish: Match adjacent glazed aluminum curtain wall.
  - B. Materials:
    - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      - a. Sheet and Plate: ASTM B209 (ASTM B 209M).
      - b. Extruded Bars, Rods, Profiles and Tubes: ASTM B 221 (ASTM B 221M).
      - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      - d. Structural Profiles: ASTM B 308/B 308M.

# 2.6 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

### 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  - 4. Physical and thermal isolation of glazing from framing members.
  - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
  - 1. At exterior doors, provide compression weather stripping at fixed stops.
  - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
  - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

#### 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. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
  - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

G. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

# 3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
  - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
  - 2. Alignment:
    - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
    - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

# 3.4 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
  - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

# 1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

- a. Swinging doors.
- b. Non-fire-rated sliding doors.
- c. Non-fire-rated folding doors.
- d. Other doors to the extent indicated.

2.Cylinders for doors specified in other Sections.3.Electrified door hardware.

- B. Related Sections include the following:
  - 1.Division 08 Section "Hollow Metal Doors and Frames" for astragals provided as part of fire-rated labeled assemblies and for door silencers provided as part of hollow-metal frames.
  - 2. Division 08 Section "Aluminum Frames" for door silencers provided as part of frames.
  - 3.Division 08 Section "Flush Wood Doors" for astragals and integral intumescent seals provided as part of fire-rated labeled assemblies.
  - 4. Division 08 Section "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.
  - 5.Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, including cylinders.
  - 6.Division 08 Section "Automatic Entrances" for entrance door hardware, including cylinders.
  - 7.Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.Pivots, thresholds, weather-stripping and cylinders for locks specified in other Sections. 2.Permanent cores to be installed by Owner.

#### 1.3 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 1.Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- B. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- C. Other Action Submittals:
  - 1.Door Hardware Sets: Prepared by or under the supervision of an Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
  - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
  - c. Content: Include the following information:
    - 1) Identification number, location, hand, fire rating, and material of each door and frame.
    - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
    - 3) Complete designations of every item required for each door or opening including name and manufacturer.
    - 4) Fastenings and other pertinent information.
    - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
    - 7) Mounting locations for door hardware.
    - 8) Door and frame sizes and materials.
    - 9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      - Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
    - 10) List of related door devices specified in other Sections for each door and frame.
  - d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples,

Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

- e. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.
  - 2.Keying Schedule: Prepared by or under the supervision of an Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Approval of shop drawings and final "Field Use Drawings" are provided to the contractor. Include schematic keying diagram and index each key set to unique door designations.

# 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 and UBC Standard 7-2.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1.Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

- 2. Preliminary key system schematic diagram.
- 3. Requirements for key control system.
- 4. Address for delivery of keys.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
  - 1.Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.

2. Review sequence of operation for each type of electrified door hardware.

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. Review required testing, inspecting, and certifying procedures.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

# 1.6 COORDINATION

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building control system.
- D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

# 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
- b. Faulty operation of operators and door hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One (1) year from date of Substantial Completion, except as follows:

- a. Exit Devices: Two (2) years from date of Substantial Completion.
- b. Manual Closers: Ten (10) years from date of Substantial Completion.

# 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

# PART 2 - PRODUCTS

# 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule and door hardware sets indicated in Part 3 "Door Hardware Sets".
  - 1.Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and [named manufacturers' products, products equivalent in function and comparable in quality to named products, products complying with BHMA standard referenced.
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1.Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
  - 2.References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, manufacturers specified.
  - 2.Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
  - 1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
  - 2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
  - 3.Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
  - 4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
  - 1. Entrance Doors: Antifriction-bearing hinges.
  - 2. Doors with Closers: Antifriction-bearing hinges.
  - 3. Interior Doors: Antifriction-bearing hinges.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - 1.Exterior Hinges: Stainless steel, with stainless-steel pin, Brass, with stainless-steel pin body and brass protruding heads.
  - 2.Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads Steel, with steel pin, Stainless steel, with stainless-steel pin.
  - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainlesssteel pin.
- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
  - 1.Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
  - 2.Corners: Square
- F. Fasteners: Comply with the following:
  - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - 2. Wood Screws: For wood doors and frames.
  - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
  - 4.Screws: Phillips flat-head; [machine screws (drilled and tapped holes) for metal doors] [wood screws for wood doors and frames]. Finish screw heads to match surface of hinges.
- 2.3 HINGES
  - A. Butts and Hinges: BHMA A156.1 Listed under Category A in BHMA's "Certified Product Directory."
  - B. Template Hinge Dimensions: BHMA A156.7.
  - C. Manufacturers:
    - 1.Hager Companies (HAG). 2.Stanley Hardware;

3.Ives: Div. of Allegion 4.McKinney Hinge: Div. of ASSA ABLOY

## 2.4 CONTINUOUS HINGES

A. Standard: BHMA A156.26, Grade 1-300

1.Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.

- C. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
  - 1. Manufacturers:
  - a. Hager Companies (HAG).
  - b. Stanley Hardware;
  - c. Ives : Div. of Allegion
  - d. McKinney Hinge: Div. of ASSA ABLOY

#### 2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with "Uniform Federal Accessibility Standards."]
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
- D. Lock Trim:

1.Levers: Cast. 2.Escutcheons (Roses):

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1.Locks: Minimum 9/16-inch (19-mm) latchbolt throw. 2.Deadbolts: Minimum 1-inch (25-mm) bolt throw.

- F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
- G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

- 1. Strikes for Locks and Latches: ANSI A115.2.
- 2. Strikes for Auxiliary Deadlocks: as recommended by manufacturer.
- 3.Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

# 2.6 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1.Locks: ANSI A156.2 series 4000 Grade 1

2.Manufacturers:

a. Best Access Systems; 9K series and 45H series – No Substitute per sets

# 2.7 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1 Coordinate subparagraph and list below with Part 2 "Scheduled Door Hardware" Article. Retain "Available" for nonproprietary and delete for semiproprietary specifications.

1.Manufacturers:

a. Best Access Systems; **No Substitute** 

# 2.8 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

 Half-Round Surface Bolts: Minimum 7/8-inch (22-mm) throw.
 Interlocking Surface Bolts: Minimum 15/16-inch (24-mm) throw.
 Fire-Rated Surface Bolts: Minimum 1-inch (25-mm) throw; listed and labeled for firerated doors.
 Dutch-Door Bolts: Minimum 3/4-inch (19-mm) throw.
 Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Flush Bolts: BHMA A156.16, Grade 1 designed for mortising into door edge.

1. Manufacturers:

- a. Hager Companies (HAG).
- b. IVES Hardware; an Allegion (IVS).
- c. Rockwood; Div. of ASSA ABLOY
- d. Stanley Hardware;

## 2.9 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1 Verify requirements with authorities having jurisdiction.
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with "Uniform Federal Accessibility Standards."

1.Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
- H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  - 1.Operation: Rigid or Movable Retain paragraph and subparagraph below if exit device levers, knobs, and pulls are required to match lockset and latchset designs. Matching locksets to exit device trim and levers limits the design options available; coordinate with lock design selected in "Locks and Latches, General" Article.
- I. Outside Trim: Lever, Lever with cylinder, Pull, Pull with cylinder, Thumb turn with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors.
- K. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet (4.9 m) of cord to route wiring off the door frame.
- L. Manufacturers:

1.Von Duprin; 33 AND 99 SERIES 2.Precision Exits; 2000 series 3.Sargent 80 series

## 2.10 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  - 1.Number of Pins: [Seven].
  - 2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  - 3.Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 4. Bored-Lock Type: Cylinders with tailpieces to suit locks.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  - 1.Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Construction Keying: Comply with the following: 1.Construction Cores: Provide construction cores that are replaceable by permanent
  - cores. Provide 10 construction master keys. Provide construction cores for exterior doors and four interior storage room doors.
  - a. Furnish permanent cores to Owner for installation.
- E. Manufacturers: Best No Substutite per owners existing system
- 2.11 KEYING
  - A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
     1.Existing System: Master key or grand master key locks to Owner's existing system.
  - B. Keys: Nickel silver.
    - 1.Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: "DO NOT DUPLICATE." Information to be furnished by Owner.

2. Quantity: In addition to one extra key blank for each lock, provide the following:

- a. Cylinder Change Keys: Three.
- b. Master Keys: Five.
- c. Grand Master Keys: Five.
- d. Great-Grand Master Keys: Five.
- 2.12 ELECTRIC STRIKES
  - A. Standard: BHMA A156.31[, Grade 1]
  - B. General: Use fail-secure electric strikes with fire-rated devices.

C. Manufacturers: 1.Hes; an ASSA ABLOY Group company (FAS).

# 2.13 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from [stainless steel], unless otherwise indicated.

### C. Manufacturers:

1.Hager Companies (HAG).
 2.IVES Hardware; an Allegion (IVS).
 3.Rockwood Manufacturing Company (RM).

# 2.14 ACCESSORIES FOR PAIRS OF DOORS

A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

1. Material: Polished brass or bronze, with strike plate.

# 2.15 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with "Uniform Federal Accessibility Standards." Comply with the following maximum opening-force requirements:
  - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
  - b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
  - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
- F. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.
- G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated
frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

H. Surface Closers: BHMA A156.4 [, Grade 1 Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1.Manufacturers:

- a. LCN Closers; Allegion (LCN). 4040 SERIES
- b. Sargent; 280 Series
- c. Stanley; D4550 series

#### 2.16 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material indicated in door hardware sets. The following material:

1.Material: 0.050-inch- (1.3-mm-) thick stainless steel. 2.Manufacturers:

- a. Hager Companies (HAG).
- b. IVES Hardware; Allegion (IVS).
- c. Rockwood Manufacturing Company (RM).

#### 2.17 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1
  - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1 Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1 Combination Overhead Stops and Holders: BHMA A156.8 [, Grade 1Electromagnetic Door Holders: BHMA A156.15. Listed under Category C in BHMA's "Certified Product Directory."
  - 1.Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.
- C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.
- D. Manufacturers:

Glynn-Johnson; Allegion (GJ).
 Hager Companies (HAG).
 ABH Companies

#### 2.18 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

- C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 UBC Standard 7-2.
  - 1.Test Pressure: Test at atmospheric pressure After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Manufacturers:

1.Hager Companies (HAG). 2.National Guard Products (NGP). 3.Pemko 4.Reese 5.Zero

- 2.19 THRESHOLDS
  - A. Standard: BHMA A156.21. [Listed under Category J in BHMA's "Certified Product Directory."
  - B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with "Uniform Federal Accessibility Standards."

- 1.Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Manufacturers:

1.Hager Companies (HAG). 2.National Guard Products (NGP). 3.Pemko 4.Reese 5.Zero

## 2.20 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosures; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Auxiliary Hardware: BHMA A156.16, Grade 1 Coordinate subparagraph and list below with Part 2 "Scheduled Door Hardware" Article.

1.Manufacturers:

- a. Don-Jo Mfg., Inc. (DJO).
- b. Hager Companies (HAG).

## 2.21 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1.Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the

only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt. 2. Steel Machine or Wood Screws: For the following fire-rated applications:

- a. Mortise hinges to doors.
- b. Strike plates to frames.
- c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

- a. Surface hinges to doors.
- b. Closers to doors and frames.
- c. Surface-mounted exit devices.

4.Spacers or Sex Bolts: For through bolting of hollow-metal doors.5.Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.22 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

- 1.Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

## 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated [on Drawings] [as follows] unless otherwise indicated or required to comply with governing regulations.
  - 1.Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2.Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3.Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1.Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2.Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings in equipment room. Verify location with Architect.
  - 1. Configuration: Provide one power supply for each door opening.
  - 2.Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

#### 3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1.Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

#### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1.Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2.Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3.Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

## 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

#### 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

## Hardware Sets:

Set # 1 Opening # 103A, 104A, 105A, 106A, 107A, 108A, 109A, 110A, 123, 136A, 140C, 143, 151, 152B, 201A, 202A, 203A, 204A, 205A, 206A, 207A, 208A, 209A, 210A, 211A, 223

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 236W	US32D	Wall Stop

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

# Set # 2 Opening # 103B, 108B, 109B, 110B, 127A, 127B, 132A, 132B, 141D, 154B, 226A, 226B

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 9K3OL 15D S3	626	Privacy
(1) 4040XP R w/PA	Alum	Closer
(1) 236W	US32D	Wall Stop

Set # 3 Opening # 142A, 152A, 152A.1, 152C

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K3ON 15D S3	626	Passage
(1) 236W	US32D	Wall Stop

Set #4 Opening # 127, 131B, 132, 134, 135, 135A, 136B, 137, 138, 139, 141C, 142, 154, 226

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 9K37AB 15D S3	626	Entrance
(1) 236W	US32D	Wall Stop

Set # 5 Opening # 225, 227, 200SD

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 4040XP SCUSH	Alum	Closer
(1) 236W	US32D	Wall Stop

Set # 6 Opening # 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 120A.1, 120A.2, 120B.1, 120B.2, 121A, 121B, 122, 141E, 141H, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 221A.1,

221A.2, 221B.1, 221B.2

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 45H7AT 15H S1 VIT	626	Office w/ Indicator Inside
(1) 236W	US32D	Wall Stop

Set # 7 Opening # 129, 144, 153, 222

(6) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(2) 282D 12"	626	Flush Bolts
(2) 4040XP SHCUSH	Alum	Closer / Hold
(2) 236W	US32D	Wall Stop

## Set #8 Opening # 133, 200SD

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 4040XP SCUSH	Alum	Closer
(1) 5050	Grey	Gasket
(1) 236W	US32D	Wall Stop

Set # 9 Opening # 100SE, 146, 147, 200SA.1

(3) BB1279 4 ½" x 4 ½"	US26D	Hinges
(1) 99L	US26D	Exit
(1) 1E72	626	Rim Cylinder

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(1) 4040XP SCUSH	Alum	Closer
(1) 236W	US32D	Wall Stop

Set # 10 Opening # 230A, 230B

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) WH 99L	US26D	Exit
(1) 1E72	626	Rim Cylinder
(1) 4040XP REG	Alum	Closer
(1) 160V	Alum	Weather strip
(1) 896V	Alum	Threshold
(1) 236W	US32D	Wall Stop

Set # 11 Opening # 100SA, 100SB, 200SA, 200SC, 300SA

(6) BB1279 4 ½" x 4 ½"	US26D	Hinges
(2) 9947 L- BE -F WDC	US26D	Exits
(2) 4040XP EDA	Alum	Closer
(2) SEM7840	Alum	Mag Hold Open
(1) 5050	Grey	Gasket
(2) 236W	US32D	Wall Stop

Set # 12 Opening # 100SA.1, 100SB.1, 150A

(6) BB1191	4 ½" x 4 ½" NRP	US32D	Hinges
(1) 9947 L		US26D	Exits

(1) 9947 L - DT	US26D	Exits
(1) 1E72	626	Rim Cylinder
(2) 4040XP SCUSH	Alum	Closer
(2) 4040XP 18PA	Alum	Plate
(2) 4040XP 30	Alum	Support
(2) 4040XP 61	Alum	Spacer
(2) 679-05	Black	Door Position Switch
(1) 896V	Alum	Threshold
(2) 236W	US32D	Wall Stop

\*\*Weather strip by Alum Door Provider\*\*

Set # 13 Opening # 145

(6) BB1279 4 ½" x 4 ½"	US26D	Hinges
(2) 9947 L	US26D	Exits
(2) 1E72	626	Rim Cylinder
(2) 4040XP EDA	Alum	Closer
(2) 679-05	Black	Door Position Switch
(2) 236W	US32D	Wall Stop

# Set # 14 Opening # 140D, 140E

(6) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K37R 15D S3	626	Classroom
(2) 282D 12"	626	Flush Bolts
(2) 4040XP SHCUSH	Alum	Closer / Hold
(2) 236W	US32D	Wall Stop

Set # 15 Opening # 100.2A, 100.3A, 100.4A

(6) BB1191 4 ½" x 4 ½" NRP	US32D	Hinges
(2) 330	US26D	Dummy Exits
(2) 23Q	US32D	Pulls
(2) 4040XP SCUSH	Alum	Closer
(2) 4040XP 18PA	Alum	Plate
(2) 4040XP 30	Alum	Support
(2) 4040XP 61	Alum	Spacer
(2) 236W	US32D	Wall Stop

Set #16 Opening #150C

(6) BB1191 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> " NRP	US32D	Hinges
(2) 9947 L	US26D	Exits
(2) 1E72	626	Rim Cylinder
(2) 4040XP SCUSH	Alum	Closer
(2) 4040XP 18PA	Alum	Plate
(2) 4040XP 30	Alum	Support
(2) 4040XP 61	Alum	Spacer
(2) 679-05	Black	Door Position Switch
(2) 236W	US32D	Wall Stop

Set # 17 Opening # 100.1, 100.1A, 100.2, 100.3, 100.4, 150B

(6) BB1191 4 <sup>1</sup> ⁄ <sub>2</sub> " x 4 <sup>1</sup> ⁄ <sub>2</sub> " NRP	US32D	Hinges
----------------------------------------------------------------------------------	-------	--------

(1) EPT- 10	SP28	Power Transfer
(1) QEL9947 L	US26D	Exits Active
(1) 9947 L - DT	US26D	Exits
(1) 1E72	626	Rim Cylinder
(1) PS902		Power Supply
(2) 4040XP SCUSH	Alum	Closer
(2) 4040XP 18PA	Alum	Plate
(2) 4040XP 30	Alum	Support
(2) 4040XP 61	Alum	Spacer
(2) 679-05	Black	Door Position Switch
(1) 896V	Alum	Threshold
(2) 236W	US32D	Wall Stop

\*\*Weather strip by Alum Door Provider\*\*

\*\* Card Reader / Keypad by Access Control Provider\*\*

# Set # 18 Opening # 130A, 130C

(3) BB1191 4 <sup>1</sup> ⁄ <sub>2</sub> " x 4 <sup>1</sup> ⁄ <sub>2</sub> " NRP	US32D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 1500	630	Elec Strike
(1) PS902		Power Supply
(1) 4040XP SCUSH	Alum	Closer
(1) 4040XP 18PA	Alum	Plate
(1) 4040XP 30	Alum	Support
(1) 4040XP 61	Alum	Spacer
(1) 679-05	Black	Door Position Switch
(1) 236W	US32D	Wall Stop

# Set # 19 Opening # 130B

(3) BB1191 4 ½" x 4 ½" NRP	US32D	Hinges
(1) 9K37DR 15D S3	626	Classroom / Storeroom
(1) 1500	630	Elec Strike
(1) PS902		Power Supply
(1) 4040XP SCUSH	Alum	Closer
(1) 4040XP 18PA	Alum	Plate
(1) 4040XP 30	Alum	Support
(1) 4040XP 61	Alum	Spacer
(1) 679-05	Black	Door Position Switch
(1) 236W	US32D	Wall Stop
(1) 701RD EX	630	Pushbutton

Set # 20 Opening # 100E.1

(6) BB1191 4 <sup>1</sup> ⁄ <sub>2</sub> " x 4 <sup>1</sup> ⁄ <sub>2</sub> " NRP	US32D	Hinges
(1) EPT- 10	SP28	Power Transfer
(1) QEL9947 L	US26D	Exits Active
(1) 9947 L - DT	US26D	Exits
(1) 1E72	626	Rim Cylinder
(1) PS902		Power Supply
(2) 4040XP SCUSH	Alum	Closer
(2) 679-05	Black	Door Position Switch
(1) 896V	Alum	Threshold

(1) 160V	Alum	Weather strip
(2) 236W	US32D	Wall Stop

# Set # 21 Opening # 140F, 141

(3) BB1191 4 ½" x 4 ½" NRP	US32D	Hinges
(1) EPT- 10	SP28	Power Transfer
(1) QEL9947 L	US26D	Exits Active
(1) 1E72	626	Rim Cylinder
(1) PS902		Power Supply
(1) 4040XP SCUSH	Alum	Closer
(1) 679-05	Black	Door Position Switch
(1) 896V	Alum	Threshold
(1) 160V	Alum	Weather strip
(1) 236W	US32D	Wall Stop

\*\* Card Reader / Keypad by Access Control Provider\*\*

# Set # 22 Opening # 100E.2

(6) BB1191 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> " NRP	US32D	Hinges
(2) 9947 L -BE	US26D	Exits - Passage
(2) 4040XP SCUSH	Alum	Closer
(2) 236W	US32D	Wall Stop

# Set # 23 Opening # 100A.2

(6) BB1191 4 <sup>1</sup> ⁄ <sub>2</sub> " x 4 <sup>1</sup> ⁄ <sub>2</sub> " NRP	US32D	Hinges
(1) EPT- 10	SP28	Power Transfer
(1) QEL9947 L	US26D	Exits Active
(1) 9947 L - DT	US26D	Exits
(1) 1E72	626	Rim Cylinder
(1) PS902		Power Supply
(2) 4040XP SHCUSH	Alum	Closer Hold
(2) 679-05	Black	Door Position Switch
(2) 236W	US32D	Wall Stop

Set # 24 Opening # 136

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K37YR 15D S3	626	Special – No exterior trim
(1) 4040XP REG	Alum	Closer
(1) 236W	US32D	Wall Stop

# Set # 25 Opening # 130D

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 1500	630	Elec Strike
(1) PS902		Power Supply
(1) 4040XP REG	Alum	Closer
(1) 679-05	Black	<b>Door Position Switch</b>

(1) SEM7840	Alum	Mag Hold Open
(1) 236W	US32D	Wall Stop

# Set # 26 Opening # 131A

(3) BB1279 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) 9K37D 15D S3	626	Storeroom
(1) 4040XP REG	Alum	Closer
(1) SEM7840	Alum	Mag Hold Open
(1) 236W	US32D	Wall Stop

# Set # 27 Opening # 125, 126

\*\*Paladin Series FP14 Frame and PW14 door assembly with approved Hardware\*\*

(3) 5BB1HW 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) WS9957 L -F	US26D	Exits
(1) 1E72	626	Rim Cylinder
(1) 4040XP SCUSH	Alum	Closer
(1) 5050	Grey	Gasket
(1) 236W	US32D	Wall Stop

## Set # 28 Opening # 100B, 100C.1

\*\*Paladin Series FP14 Frame and PW14 door assembly with approved Hardware\*\*

(6) 5BB1HW 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(2) WS9927 L -F	US26D	Exits
(2) 1E72	626	Rim Cylinder
(2) 4040XP SCUSH	Alum	Closer
(2) SEM7840	Alum	Mag Hold Open

(1) 5050	Grey	Gasket
(2) 236W	US32D	Wall Stop

# Set # 28 Opening # 100C.2

\*\*Paladin Series FP14 Frame and PW14 door assembly with approved Hardware\*\*

(6) 5BB1HW 4 <sup>1</sup> / <sub>2</sub> " x 4 <sup>1</sup> / <sub>2</sub> "	US26D	Hinges
(1) EPT- 10	SP28	Power Transfer
(1) PS902		Power Supply
(1) QEL WS9927 L -F	US26D	Exits
(1) WS9927 L -F	US26D	Exits
(2) 1E72	626	Rim Cylinder
(2) 4040XP SCUSH	Alum	Closer
(2) SEM7840	Alum	Mag Hold Open
(2) 679-05	Black	Door Position Switch
(1) 5050	Grey	Gasket
(2) 236W	US32D	Wall Stop

\*\* Card Reader / Keypad by Access Control Provider\*\*

END OF SECTION 087100

SECTION 088000 - GLAZING

## 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. SECTION 12300, ALTERNATES

#### 1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Doors.
  - 2. Glazed entrances.
  - 3. Interior borrowed lites.
  - 4. Security Lamination

#### 1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

## 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass

lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

- 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
  - a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures" : Section 6.0 "Wind Loads."
  - b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
    - 1) Load Duration: 60 seconds or less.
  - c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
    - 1) For monolithic-glass lites heat treated to resist wind loads.
    - 2) For insulating glass.
  - d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
  - e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
  - 1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  - 2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
    - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
    - b. Solar Heat Gain Coefficient: NFRC 200.
    - c. Solar Optical Properties: NFRC 300.

## 1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

- B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
  - 1. Tinted glass.
  - 2. Insulating glass for each designation indicated.
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- D. Qualification Data: For installers.
- E. Product Test Reports: For each of the following types of glazing products:
  - 1. Tinted float glass.
  - 2. Insulating glass.
  - 3. Glazing gaskets.
- F. Warranties: Special warranties specified in this Section.

# 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
  - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
  - 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA's "Glazing Manual."

- 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
  - 1. Insulating Glass Certification Council.
- G. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicated manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg. F (250 deg. C), and the fire-resistance rating in minutes.

# 1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

# 1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

## 1.9 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Basis of Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers listed.
- 2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
  - 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  - 3. For uncoated glass, comply with requirements for Condition A.
  - 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
  - 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heatstrengthened) float glass where safety glass is indicated.
- C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
  - 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  - 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
  - 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulatingglass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
  - 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
    - a. Manufacturer's standard sealants.
  - 5. Spacer Specifications: Manufacturer's standard spacer material and construction.
    - a. Corner Construction: Manufacturer's standard corner construction.

## 2.3 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene.
  - 2. EPDM.
  - 3. Silicone.
  - 4. Thermoplastic polyolefin rubber.
  - 5. Any material indicated above.

## 2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

# 2.5 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

## 2.6 SECURITY LAMINATION

- A. Security Lamination:
  - 1. Basis of Design Product:
    - a. School Guard Glass SG4

## 2.7 INSULATING-GLASS UNITS

- A. Insulating-Glass Units:
  - 1. Basis of Design Product:
    - a. PPG Solarban 60 on Clear Low E #2 Glass or a comparable product by one of the following:
      - 1) AFG Glass
      - 2) Viracon
  - 2. Overall Unit Thickness and Thickness of Each Lite: Comply with wood odor and window manufacturer standards.
  - 3. Interspace Content: Air.
  - 4. Outdoor Lite: Class 2 (Clear) float glass.
    - a. Tint Color: Clear.
    - b. Annealed, Kind HS (heat strengthened), Kind FT (fully tempered).
  - 5. Indoor Lite: Class 1 (clear)float glass.

- 6. Visible Light Transmittance: .70 percent minimum.
- 7. Winter Nighttime U-Factor: .29 maximum.
- 8. Summer Daytime U-Factor: .27 maximum.
- 9. Solar Heat Gain Coefficient: .39 percent maximum.
- B. Ceramic-Coated Spandrel Insulating Glass Units:
  - 1. Construction: Provide units that comply with requirements specified for insulating-glass unit designated IG except for indoor lite.
  - 2. Indoor Lite: Ceramic-coated spandrel glass.
    - a. Kind HS (heat strengthened), FT (fully tempered).
    - b. Ceramic Coating Location: Fourth surface.
    - c. Color: Match insulated glass units.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

## 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.
- 3.4 GASKET GLAZING (DRY)
  - A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
  - B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
  - C. Install gaskets so they protrude past face of glazing stops.

# 3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

## 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. Fixed, extruded-aluminum louvers.
- B. Related Sections:
  1. Division 23 Sections for louvers that are a part of mechanical equipment.

#### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft. (957 Pa), acting inward or outward.
- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of metal finish required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

## 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

- 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
- 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Channel unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
  - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- F. Provide subsills made of same material as louvers for recessed louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Model A4097 as manufactured by Construction Specialties, Inc. or a comparable product by one of the following:
    - a. Airolite Company, LLC (The).
    - b. American Warming and Ventilating, Inc.; a Mestek company.

- c. Arrow United Industries; a division of Mestek, Inc.
- d. Cesco Products; a division of Mestek, Inc.
- e. Construction Specialties, Inc.
- f. Greenheck Fan Corporation.
- g. Industrial Louvers, Inc.
- h. Reliable Products, Inc.
- i. Ruskin Company; Tomkins PLC.
- 2. Louver Depth: 4 inches.
- 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm), 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
- 4. Mullion Type: Exposed.
- 5. Louver Performance Ratings:
  - a. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
- 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Bird screening except where insect screening is indicated.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
  - 2. Finish: Mill finish unless otherwise indicated.
  - 3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
  - 1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

## 2.5 FINISHES, GENERAL

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

## 2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

- B. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2604, AAMA 2605 and containing not less than 50, 70 percent 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.
  - 1. Color and Gloss: As selected by Architect from manufacturer's standard selections.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. 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.

#### 3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. 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.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

## 3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. 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 during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. 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.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089000

SECTION 090561.13 - MOISTURE VAPOR EMISSION CONTROL

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 fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

#### 1.3 UNIT PRICES

A. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

#### 1.4 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.
- 1.5 ACTION SUBMITTALS
  - A. Product Data: For each type of product.
- 1.6 INFORMATIONAL SUBMITTALS
  - A. Qualification Data: For Installer.
  - B. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.
  - C. Preinstallation testing reports.
  - D. Field quality-control reports.

#### 1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
  - Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F (18 deg C) and not more than 85 deg F (29.4 deg C) at least 48 hours before use.
  - 2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29.4 deg C) and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
  - 3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F (3 deg C) higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

# PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
  - 1. MVER: Maximum 25 lb of water/1000 sq. ft. (11.34 kg of water/92.9 sq. m) when tested according to ASTM F 1869.
  - 2. Relative Humidity: Maximum 100 percent when tested according to ASTM F 2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.

## 2.2 MVE-CONTROL SYSTEM

- A. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
  - 1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
  - Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

#### 2.3 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVEcontrol system manufacturer's gypsum or hydraulic cement-based underlayment.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of system indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Preinstallation Testing:
  - 1. Testing Agency: Engage a qualified testing agency to perform tests.
  - 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
  - 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

- a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
- b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVEcontrol system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
- 4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.
  - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
  - 1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
  - 2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
  - 3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
  - 4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
  - 5. Fill surface depressions and irregularities with patching and leveling material.
  - 6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
  - 7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
  - 8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.
- C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

## 3.3 INSTALLATION

- A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
  - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVEcontrol system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

# 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
  - 1. Verify that surface preparation meets requirements.
  - 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
  - 3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.
- C. MVE-control system will be considered defective if it does not pass inspections.

# 3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 090561.13

# SECTION 092116 - GYPSUM BOARD SHAFT WALL 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. This Section includes gypsum board shaft-wall assemblies for the following:
  - 1. Shaft-wall enclosures.
- B. Related Sections include the following:
  - 1. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board shaft-wall assemblies.

#### 1.3 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

## 1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Gypsum Company.
  - 2. G-P Gypsum.
  - 3. National Gypsum Company.
  - 4. Temple-Inland Forest Products Corporation.
  - 5. USG Corporation.

### 2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

- A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
  - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
  - 2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

#### 2.3 PANEL PRODUCTS

- A. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.
- B. Gypsum Board: As specified in Division 09 Section "Gypsum Board."
- C. Water-Resistant Gypsum Backing Board: As specified in Division 09 Section "Gypsum Board."

### 2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Framing Members: Comply with ASTM C 754 for conditions indicated.
- B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

# 2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
- C. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."
- D. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- F. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
  - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- G. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- H. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
  - 1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

#### 2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

- A. Fire-Resistance Rating: 2 hours.
- B. STC Rating: 51, minimum.
- C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
  - 1. Depth: As indicated.

- 2. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
- D. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
- E. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.
- F. Insulation: Sound attenuation blankets.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fireresistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
  - 1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
  - 2. Division 09 Section "Gypsum Board" for applying and finishing panels.
- B. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
- C. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- D. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- E. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain

an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

# 3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116

# 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. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
- B. Related Sections include the following:
  - 1. Division 05 Section "Cold-Formed Metal Framing" for interior load-bearing wall studs and floor framing.
  - 2. Division 07 Section "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.

# 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

#### 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate nonload-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

# PART 2 - PRODUCTS

## 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

# 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to [5] <Insert number> times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosionresistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.
- E. Furring Channels (Furring Members):
  - 1. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
    - b. Depth: As indicated on Drawings.
  - 2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
    - a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.

# 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).
    - a. 0.0312 inch for head, sill, jamb and cripple studs at door and other openings.
    - b. 0.0312 inch in locations to receive ceramic wall tile finish.
  - 2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Provide one of the following:

- 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
- 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
- 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
    - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
    - b. Metal-Lite, Inc.; The System.
- D. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.
  - 1. Depth: 1-1/2 inches (38.1 mm).
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
  - 2. Depth: As indicated on Drawings.

# 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide[ one of] the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
  - 1. 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.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- 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 connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

# 3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
  - 1. Space studs as follows:
    - a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
    - c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

- 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
  - a. Install two studs at each jamb, unless otherwise indicated.
  - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
  - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistancerated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
  - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs.
- D. Direct Furring:
  - 1. Attach to concrete or masonry with screws designed for masonry attachment, or powderdriven fasteners spaced 24 inches (610 mm) o.c.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

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. This Section includes the following:
  - 1. Interior gypsum board.
  - 2. Tile backing panels.
- B. Related Sections include the following:
  - 1. Division 05 Section "Cold-Formed Metal Framing" for load-bearing steel framing.
  - 2. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
  - 3. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

### 1.4 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

# 1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged. Replace installed panels that become wet or moisture damaged during construction.
  - 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.

## PART 2 - PRODUCTS

#### 2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

# 2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum Co.
    - b. G-P Gypsum.
    - c. National Gypsum Company.
    - d. USG Corporation.
- B. Type X:
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
  - 1. Core: 5/8 inch (15.9 mm), type X.

- 2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
- 3. Indentation: ASTM C 1629 C 1629/C 1629M, meets or exceeds Level 2 requirements.
- 4. Soft Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2, Level 3 requirements.
- 5. Hard Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 1, Level 2 requiremettns according to test in Annex A1.
- 6. Long Edges: Tapered.
- 7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- 8. Install four foot above finished floor where indicated.

### 2.3 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. G-P Gypsum.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Core: 5/8 inch (15.9 mm), Type X.
- B. Cementitious Backer Units: ANSI A 118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. C-Cure; C-Cure Board 990.
    - b. CertainTeed Corporation; Fiber Cement Backer Board
    - c. National Gypsum Company, Permabase Cement Board.
    - d. USG Corporation; DUROCK Cement Board.
  - 2. Thickness: 5/8 inch (15.9 mm).
  - 3. Mold Resistance: ASTMD 3273, score of 10 as rated according to ASTM D3274.

## 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. L-Bead: L-shaped; exposed long flange receives joint compound.
    - d. Expansion (control) joint.
    - e. Curved-Edge Cornerbead: With notched or flexible flanges.

# 2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Exterior Gypsum Soffit Board: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and settingtype, sandable topping compound.
  - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

#### 2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- 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 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- 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 (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

# 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Type X: Vertical and ceiling surfaces, unless otherwise indicated.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
  - 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  - 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
  - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
  - For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

# 3.4 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install at bathroom walls not subject to wetting. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A 108.11 at showers, tubs and where indicated.

# 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. LC-Bead: Use at exposed panel edges
  - 3. L-Bead: Use where indicated
  - 4. Curved-Edge Cornerbead: Use at curved openings.

# 3.6 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, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile, Panels that are substrate for acoustical tile.
  - 3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  - 4. Level 5: Where indicated on Drawings>.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.

# 3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. 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.

### END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

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. Porcelain tile.
  - 2. Glazed wall tile.
  - 3. Tile backing panels.
  - 4. Waterproof membrane for thinset applications.
  - 5. Metal edge strips.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
  - 2. Section 092900 "Gypsum Board" for cementitious backer units, glass-mat, waterresistant backer board.
  - 3. Section 093023 "Glass Tiling."

#### 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

CERAMIC TILING

# 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required.
  - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
  - 3. Full-size units of each type of trim and accessory for each color and finish required.
  - 4. Metal edge strips in 6-inch (150-mm) lengths.

# 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of product.
- C. Product Test Reports: For tile-setting and -grouting products.

# 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer employs installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of floor tile installation, where indicated on drawings.
  - 2. Build mockup of wall tile installation where indicated on drawings.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

# 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

### 1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Waterproof membrane.
  - 2. Cementitious backer units.
  - 3. Metal edge strips.

# 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements.

# CERAMIC TILING

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

# 2.3 TILE PRODUCTS

- A. Ceramic Tile Type CT1, CT2, CT3: Glazed porcelain tile.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Crossville
    - b. Atlas Concord
    - c. Daltile
    - d. Anatolia
    - e. Florim
    - f. Florida Tile
    - g. Cesar Stone
  - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
  - 3. Face Size Variation: Rectified.
  - 4. Face: Plain with square edges.
  - 5. Thickness: 3/8".
  - 6. Shade Variation: V1.
  - 7. Pattern: Solid.
- B. Ceramic Tile Type CT4, CT5, CT6: Porcelain tile.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Crossville
    - b. Atlas Concord
    - c. Daltile
    - d. Anatolia
    - e. Florim
    - f. Florida Tile
    - g. Cesar Stone
  - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
  - 3. Face Size Variation: Rectified or square.
  - 4. Face: Plain with square edges.
  - 5. Thickness: 3/8".
  - 6. Shade Variation: V2.
  - 7. Appearance: Stone, textured.
  - 8. Dynamic Coefficient of Friction: Not less than 0.42.
- C. Ceramic Tile Type QT1: Quarry tile.

CERAMIC TILING

- 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Crossville
  - b. Daltile
  - c. Florida Tile
- 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
- 3. Wearing Surface: Smooth.
- 4. Thickness: 3/8".
- 5. Pattern: Solid.
- 6. Size: 6 x 6".
- 7. Dynamic Coefficient of Friction: Not less than 0.42.
- 8. Trim Units: Base-coved with surface bullnose top edge 6" x 6".

# 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
  - 1. Thickness: 1/2 inch (12.7 mm).
- B. Fiber-Cement Backer Board: ASTM C 1288, in maximum lengths available to minimize end-toend butt joints.
  - 1. Thickness: 1/2 inch (12.7 mm).
- 2.5 WATERPROOF MEMBRANE
  - A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
  - B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.
    - 1. Nominal Thickness: 0.030 inch (0.76 mm) or 0.040
  - C. <u>PVC Sheet</u>: PVC heat-fused on both sides to facings of nonwoven polyester.
  - D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.2-mm) nominal thickness.
  - E. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1 -mm) nominal thickness.
  - F. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
  - G. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
  - H. Latex-Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cementbased mix and latex additive.

### 2.6 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
  - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- B. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
  - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

# 2.7 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
  - 1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3.
  - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

### 2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; anodized aluminum over brass, exposed-edge material.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout, use when recommended by grout manufacturer.

# 2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.

CERAMIC TILING

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- C. For Slim Large Format Tile: All rough, uneven, or "out-of-plumb" surfaces must be made "plumb" and "true" to within 1/8" in 10' (3 mm in 3m) and 1/16" in 1' (1.5 mm in 300mm). Dry or dusty concrete or masonry surfaces must be water washed and excess water removed just prior to the application of membranes and mortars.

# 3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation

methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

- 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
  - a. Tile floors in wet areas.
  - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
  - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide metal L-shaped trim shapes in same height as tile and setting material where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the joint widths recommended by manufacture for each specific product at specified locations (I.E. wall, floor).
- H. Expansion Joints: Provide Metal and PVC combination expansion joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  - 2. 2. Provide Schluter®-DILEX-AKWS or similar at control and expansion joints color selected by Architect.
- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

# 3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

## 3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.6 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

#### 3.7 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
  - 1. Ceramic Tile Installation: TCNA F113; thinset mortar.
    - a. Thinset Mortar: Latex- portland cement mortar.
    - b. Grout: High-performance sanded grout.

- 2. Ceramic Tile Installation: TCNA F132; water-cleanable, tile-setting epoxy on cured cement mortar bed
- B. Interior Wall Installations, Wood or Metal Studs or Furring:
  - 1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
    - a. Thinset Mortar: Latex-portland cement mortar.
    - b. Grout: High-performance sanded grout.
- C. Bathtub/Shower Wall Installations, Wood or Metal Studs or Furring:
  - 1. Ceramic Tile Installation: TCNA B412; thinset mortar on cementitious backer units or fiber-cement backer board with waterproof membrane.
    - a. Thinset Mortar: Latex-portland cement mortar.
    - b. Grout: Water-cleanable epoxy grout.
  - 2. Slim Large Format Tile Installation: TNA W245 or TCNA W248; thinset mortar on gypsum backer board.
    - a. Type: Slimlite Panels.
    - b. Thinset Mortar: Mapel Ultra Flex LFT Rapid or equal.
    - c. Grout: High performance unsanded grout.
    - d. Follow all manufacturers guidelines for material handling and installation.

END OF SECTION 093013

# SECTION 095000 - ACOUSTICAL WOOD CEILINGS

## PART 1 - GENERAL

# **1.1 RELATED DOCUMENTS**

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section

# 1.2 SUMMARY

### A. Section Includes

- 1. Wood veneer ceiling panels
- 2. Exposed grid suspension system
- 3. Wire hangers, fasteners, main runners, wall angle moldings and accessories.

### **B. Related Sections:**

- 1. Section 095113 Acoustical Panel Ceilings
- 3. Division 23 HVAC
- 4. Division 26 Electrical

# C. Substitutions:

- Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been approved by Addenda, the specified products shall be provided without additional compensation.
- 2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

# 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
  - 1) ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-

Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

- 2) ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- 3) ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
- 4) ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- 5) ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- 6) ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
- 7) ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 8) ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
- 9) ASTM E 1264 Classification for Acoustical Ceiling Products
- B. Hardwood Plywood & Veneer Association (HPVA)
- C. International Building Code
- D. ASHRAE Standard 62 1 2004 Ventilation for Acceptable Indoor Air Quality
- E. NFPA 70 National Electrical Code
- F. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
- G. International Code Council-Evaluation Services AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
- H. International Code Council-Evaluation Services Report Seismic Engineer Report
  - 1. ESR 1308 Armstrong T-Bar or Dimensional Suspension
- I. California Air Resources Board (CARB) compliant

# **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
- B. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.

- C. Samples: Minimum 3-1/2 inch or 5-1/2 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner.
- D. Shop Drawings: Illustrating the layout and details of the ceilings. Show locations of items that are to be coordinated with, or supported by the ceilings.
- E. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- F. All products not conforming to manufacturer's current published values must be removed and dispose. Replace with complying product at the expense of the Contractor performing the work.

# **1.5 QUALITY ASSURANCE**

- A. Single-Source Responsibility: Provide ceiling panel units and grid components of each type by a single manufacturer.
- B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.
  - 1. Surface Burning Characteristics: As follows, tested by HPVA (Hardwood Plywood and Veneer Association) under the test standard ASTM E-84 tunnel test and complying with ASTM E 1264 for Class A products.
    - a. Flame Spread: 25 or less
    - b. Smoke Developed: 50 or less
- C. Woodworking Standards: Manufacturer must comply with specified provisions of Architectural Woodworking Institute quality standards.
- D. Wood Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- E. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

# 1.6 DELIVERY, STORAGE AND HANDLING

- A. Store the wood veneer ceiling panels in a dry interior location in their cartons prior to installation to avoid damage. Store the ceiling panel cartons in a flat, horizontal position. Do not remove the protectors between the panels until installation.
- B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F.

Do not expose the wood veneer ceiling panels to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

# **1.7 PROJECT CONDITIONS**

- A. Prior to installation, the wood veneer ceiling materials are required to reach room temperature and have stabilized moisture content for a minimum of 72 hours.
- B. Do not install the wood veneer panels in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.
- C. As interior finish products, the wood veneer panels are designed for installation in temperature conditions between 50 degrees F and 86 degrees F, in spaces where the building is enclosed and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 55 percent.

# **1.8 WARRANTY**

- A. Wood Veneer Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
  - 1. Ceiling Panels: Defects in materials or factory workmanship
  - 2. Grid System: Rusting and manufacturing defects
- B. Warranty Period:
  - 1. Wood veneer panels: One (1) year from date of installation
  - 2. Grid: One (1) year from date of installation
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

# 1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
  - 1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
  - 2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

# PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Wood veneer ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Based on Seismic Design Category "D" according to the following:
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
  - CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies-Seismic Zones 3 & 4".
  - 3. ASCE 7, "Minimum Design Loads for Buildings and Other Structures". Section 9, "Earthquake Loads".

## 2.2 WOOD VENEER CEILING UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceiling Panels:
    - a. ACGI, Architectural Components Group, Inc.
    - b. Armstrong World Industries, Inc.
    - c. USG
  - 2. Suspension Systems:
    - a. ACGI, Architectural Components Group, Inc.
    - b. Armstrong World Industries, Inc.
      - 1) See details on drawings for special suspension requirements and considerations. Confer with architect before ordering suspension systems and installing product.
    - c. USG
- B. Ceiling Panels Type:
  - 1. Surface Texture: Smooth
  - 2. Composition: Wood Veneer
  - 3. Species/Finish: Maple/Match Architect's Sample.
  - 4. Size: 96 x 5-1/4 x 3/4
  - 5. Reveal: 3/4"
  - 6. Profile: Square
  - 8. Edge Banding and Trim: To match face veneer
  - 9. Noise Reduction Coefficient (NRC):ASTM C 423, Classified with UL label on product carton 0.40
  - 10. Flame Spread: ASTM E84 HPVA Fire Classification (Fire Class)
  - 11. Dimensional Stability: Standard
  - 12. Acceptable Product: Provide product listed on drawings or comparable product by approved manufacture.
  - 13: Backing: None

# 2.3 WOOD VENEER CEILING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong
  - 2. USG
  - 3. ACG1
- B. Ceiling Panels Type:
  - 1. Surface Texture: Smooth.
  - 2. Composition: Wood Veneer.
  - 3. Species: Maple/Match Architect's Sample
  - 4. 42" wide x custom x 3/4".
  - 5. Reveal: 3/4".
  - 6. Profile: Square
  - 7. Edge Banding & Trim: To match face veneer.
  - 8. NRC: ASTM C 423. Classified with UL label on products carton 0.40.
  - 9. Flame Spread: ASTM E84 HPVA Free Class.
  - 10. Dimensional Stability: Standard
  - 11. Acceptable Product: Provide product listed on drawings or comparable product by approved manufacturer.

# 2.4 METAL SUSPENSION SYSTEMS

- A. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
  - a. Structural Classification: ASTM C 635 Heavy Duty duty
  - b. Color: Tech Black and match the actual color of the selected ceiling tile, unless noted otherwise.
  - c. Acceptable Product: PRELUDE XL 15/16" Exposed Tee as manufactured by Armstrong World Industries
- B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
- B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

### 3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

### 3.3 INSTALLATION

- A. Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines; approved construction drawings; with the authorities having jurisdiction; and in accordance with the manufacturer's installation instructions.
- B. Install wall moldings at intersection of suspended ceiling and vertical surfaces.

# 3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095000
## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### 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 acoustical panels and exposed suspension systems for ceilings.
- B. Related Requirements:
  - 1. Section 095123 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.
  - 2. Section 095133 "Acoustical Metal Pan Ceilings."
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: Set of 6-inch-(150-mm-)square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-(150-mm-)long Samples of each type, finish, and color.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- D. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

### 1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages 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 panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Based on Seismic Design Category "D" according to the following:
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic restraint: Comply with ASTM E 580.

- CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies-Seismic Zones 3 & 4".
- 3. ASCE 7, "Minimum Design Loads for Buildings and Other Structures". Section 9, "Earthquake Loads".
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class C materials.
  - 2. Smoke-Developed Index: 450 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; 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 ACOUSTICAL PANELS, GENERAL
  - A. Source Limitations:
    - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
    - 2. Suspension System: Obtain each type from single source from single manufacturer.
  - B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
  - C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
  - D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
    - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
  - E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
    - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- 2.3 ACOUSTICAL PANELS (APC1)
  - A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings.
  - B. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:

- 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face and sealed edges.
- 2. Pattern: E (lightly textured).
- C. Color: White.
- D. LR: 0.85.
- E. NRC: 0.55.
- F. CAC: 33.
- G. Edge/Joint Detail: Square.
- H. Thickness: 584 inch.
- I. Modular Size: 24 by 24 inches (610 by 610 mm).
- 2.4 ACOUSTICAL PANELS (APC2)
  - A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - 1. Armstrong World Industries, Inc.
    - 2. CertainTeed Corp.
    - 3. Chicago Metallic Corporation.
    - 4. USG interiors, Inc.: Subsidiary of USG Corporation.
  - B. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
    - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face and sealed edges.
    - 2. Pattern: G (smooth).
  - C. Color: White.
  - D. LR: Not less than 0.89.
  - E. CAC: Not less than 33.
  - F. Edge/Joint Detail: Square.
  - G. Thickness: 5/8"
  - H. Modular Size: 24 by 24 inches (610 by 610 mm).
  - I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold,

mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

### 2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
  - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Cast-in-place or Postinstalled expansion anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch-(3.5-mm-) diameter wire.
- D. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch-(1-mm-)thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch-(8-mm-)diameter bolts.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- H. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- I. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

## 2.6 METAL SUSPENSION SYSTEM

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corp.
  - 3. Chicago Metallic Corporation.
  - 4. USG interiors, Inc.: Subsidiary of USG Corporation.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch-(24-mm-)wide metal caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  - 3. Face Design: Flat, flush.
  - 4. Cap Material: aluminum cold-rolled sheet.
  - 5. Cap Finish: Painted to match color of acoustical unit.
- C. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation; with prefinished, cold-rolled, 15/16-inch-(24-mm-)wide aluminum caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. Face Design: Flat, flush.
  - 3. Face Finish: Painted to match color of acoustical unit.

### 2.7 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 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 that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
  - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

### 2.8 ACOUSTICAL SEALANT

- A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Acoustical sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
  - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to 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 either to structures 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 (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- 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 panels.
  - 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). 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. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.

- 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
- 6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
- 7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
- 8. Protect lighting fixtures and air ducts to comply with requirements indicated for fireresistance-rated assembly.

## 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Compliance of seismic design.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
  - 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
    - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
    - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## **Specification Note:**

The following specifications call out the material and default installation requirements necessary for the floor as recommended by Robbins Sports Surfaces. In some cases, local codes, physical requirements or installer recommendation may override these methods and procedures. It is Robbins recommendation to review the specification with a Regional Sales Manager or the local Authorized Dealer before incorporating the specification into the project design. Some options impact installed cost and verification of the design and budget is advised.

For the name of the local Robbins representative or dealer, contact Robbins at 1-800-543-1913 or on the web at www.robbinsfloor.com.

## SECTION 09 / GUIDE SPECIFICATIONS FOR **ROBBINS<sup>®</sup> BIO-CUSHION<sup>®</sup> CLASSIC FLOOR SYSTEM**

### Part 1-GENERAL

### **1.01 DESCRIPTION**

A. Related work specified under other sections. (A cross-reference should be incorporated in these sections.)

- - a. Concrete Slab Depression: 2-1/8" (54mm) for 7/16" (11mm) pad and 25/32" Flooring. (Add ¼" for 33/32" flooring)
    - 1) Options for 25/32" flooring(delete or modify above):
      - a) 1-7/8" (48mm) for 1/8" (3mm) pad.
      - b) 2" (51mm) for 1/4" (6mm) pad.
      - c) 2 1/8" (54mm) for 3/8" (10mm) pad.
      - d) 2 1/4" (57mm) for 1/2" (13mm) pad.
      - e) 2 3/8" (61mm) for 9/16" (14mm) pad.
      - f) 2 3/8" (61mm) for 5/8" (16mm) pad.
      - g) 2-1/2" (64mm) for 3/4" (19mm) pad.
    - 2) Options for 33/32" flooring(delete or modify above):
      - a) 2-1/8" (54mm) for 1/8" (3mm) pad.
      - b) 2-1/4" (57mm) for 1/4" (6mm) pad.
      - c) 2-3/8" (61mm) for 3/8" (10mm) pad.
      - d) 2-1/2" (64mm) for 1/2" (13mm) pad.
      - e) 2-5/8" (67mm) for 9/16" (14mm) pad.
      - f) 2- 5/8" (67mm) for 5/8" (16mm) pad.
      - g) 2-3/4" (70mm) for 3/4" (19mm) pad.
  - b. Surface Finish: steel troweled and finished smooth.
  - c. Concrete Tolerance: 1/8" (3mm) in radius of 10' (3m).
- d. Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized.
- 2. Membrane Waterproofing and Dampproofing......Section 07100
  - a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on the earth side of below grade walls by general contractor using suitable type membrane.
  - b. Sand-Poly-Sand slab construction **is not** an acceptable construction.

### **1.02 QUALITY ASSURANCE**

- A. Floor System Manufacturer Qualifications
  - 1. Manufacturer shall be an established firm experienced in field and have been in business or a minimum of ten (10) years; Robbins, Inc. or an approved equal.
  - 2. Manufacturer will be a member in good standing of the Maple Flooring Manufacturers Association (MFMA).
- B. Floor Contractor/Installer Qualifications and Certifications

# **ROBBINS® BIO-CUSHION® CLASSIC**

- 1. Flooring contractor shall be a firm experienced in flooring field and approved by manufacturer.
- 2. Submit a list of at least three completed projects of similar magnitude and complexity.
- C. Surface Appearance (Available option)
  - 1. Expansion spaces will not exceed 1/64" (0.4mm) at time of installation and will be spread evenly across the floor with each row of flooring.
  - 2. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).

## 1.03 SUBMITTALS

A. Manufacturer's Product Data

- 1. Submit three (3) Robbins Bio-Cushion Classic Floor System specification sheets..
- 2. Suppliers shall submit certificates attesting that materials furnished will meet specifications for grade, quality, dryness and treatment, if required.
- B. Concrete Guidelines
  - 1. Submit three (3) copies of MFMA Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive wood flooring.
  - 2. Submit Robbins Technical Services "Concrete Guide Specification" for further information regarding conditions and requirements of concrete prior to installation.
- C. Samples
  - 1. Submit one (1) sample of **BioCushion Classic**, if requested by architect. Sample to be made by the manufacturer and so indicated.
- D. Maintenance Literature
  - 1. Submit copy of Maintenance Instructions.

# **1.04 DELIVERY, STORAGE AND HANDLING**

A. Delivery of Materials

- Materials shall not be delivered, stored or installed until all masonry, painting, plastering tilework, marble and terrazzo work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit (13 to 27 degrees Celsius) and relative humidity of 35-50 % are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied
- 2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

## **1.05 JOB CONDITIONS-SEQUENCY**

- A. Do not install floor system until concrete has been cured 60 days and the requirements in paragraph 1.04 A are obtained.
- B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.
- C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit (13 to 27 degrees Celsius) and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.
- D. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or owner requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by owner (or owner's agent) of complete gymnasium floor.

## **1.06 GUARANTEE**

- A. Guarantee shall not cover damage caused in whole or in part by casualty, ordinary wear and tear, abuse, use for which material is not designed, faulty construction of the building, settlement of the building walls, failure of the other contractors to adhere to specifications, separation of the concrete slab and excessive dryness or excessive moisture from humidity, spillage, migration through the slab or wall, or any other source.
- B. Robbins, Inc. hereby warrants the **BioCushion Classic** material to be free from manufacturing defects for a period of 1 year. This warranty is in lieu of all other warranties, expressed or implied including but not limited to any warranty of merchantability or fitness for a particular purpose, and of any other obligations on the part of

Robbins. In the event of breach of any warranty, the liability of Robbins shall be limited to repairing or replacing **BioCushion Classic** material and system components supplied by Robbins and proven to be defective in manufacture, and shall not include any other damages, either direct or consequential.

## Part 2-PRODUCTS

## 2.01 MATERIALS

- A. Vapor Barrier
  - 1. 6-mil polyethylene
    - a. Options (delete or modify above):

1) Moisture Supression System(for moisture problems with the concrete slab)

- B. Subfloor
  - 1) Robbins 7/16" (11mm) EPDM Bio-Pad.
  - b. Options (delete or modify above):
    - 1) Robbins 3/4" (19mm) EPDM Bio-Pad.
    - 2) Robbins 7/16" Zero/G (11mm) Continuous Zero/G Shock Pad.
    - 3) Robbins 3/8" (10mm) PermaCushion pad.
  - c. Other Options(chosen for unusual circumstances) (delete or modify above):
    - 1) Robbins 1/8" (3mm) Volara Foam
    - 2) Robbins 1/4" (6mm) Volara Foam
    - 3) Robbins 1/4" (6mm) Zero/G Shock Pad
    - 4) Robbins 7/16" (11mm) Bio-Sport 2 Pad
    - 5) Robbins 1/2" (13mm) Volara Foam.
    - 6) Robbins 9/16" (14mm) Zero/G Shock Pad.
    - 7) Robbins 5/8" (16mm) Zero/G Shock Pad.
    - 8) Robbins 5/8" (16mm) PermaCushion Pad
    - 9) Robbins 3/4" (19mm) Bio-Sport 2 Pad
  - 2. Two layers of 15/32" (12mm) thick, 4' x 8' (1.22m x 2.44m) Exposure 1, APA Rated Sheathing.
- C. Maple Flooring
  - 25/32" (20mm) thick x 2-¼" (57mm) width, 2nd&Better grade, Unfinished TGEM, KD Northern Hard Maple, Continuous Strip<sup>®</sup> XL Flooring as manufactured by Robbins and graded in accordance with MFMA-FJ rules. Flooring will have XL<sub>plus</sub><sup>™</sup> technology to reduce or eliminate routine spacing for expansion.

## a. Options (delete or modify above):

- 1) Length
  - a) Random Length (RL)
  - 2) Thickness
    - a) 33/32"(26mm) Thickness (1 <sup>1</sup>/<sub>2</sub>" and 2 <sup>1</sup>/<sub>4</sub>" face width only)
  - 3) Face Width
    - a) 1 <sup>1</sup>/<sub>2</sub>" (38mm) face width.
    - b) 3 <sup>1</sup>/<sub>4</sub>" (83mm)face width (2<sup>nd</sup> and better grade only and not available in 33/32" thickness)
  - 4) Grade
    - a) 1st Grade
    - b) 3rd and Better (not available in 33/32" thickness x 1 <sup>1</sup>/<sub>2</sub>" face width flooring only)
    - c) 3rd Grade.
  - 5) Finish treatment
    - a) Factory-Sanded. (25/32" Flooring only)
    - b) Factory Sealed. (25/32" Flooring only)
    - c) Factory Finished (for installations requiring no painting and/or further finishing)25/32" Flooring only and not available in 3<sup>rd</sup> grade).
  - 6) Pattern
    - a) Boston Square (only available in 25/32" thickness flooring & Unfinished).
  - 7) Certified Wood
    - a) FSC certified lumber.
  - 8) Expansion Option
    - a) Standard Continuous Strip XL product may be substituted for consistently low humidity regions.
- 2. Fasteners

# **ROBBINS® BIO-CUSHION® CLASSIC**

- a. Flooring 2" (51mm) 15 gauge cleats or staples
- b. Subfloor
  - 1) 1" length, 7/16" (11mm) crown, coated staples or equivalent.
  - 2) Construction adhesive, PL400 or equivalent.
- D. Finishing Materials
  - 1. Robbins Miracle or approved equal oil-modified polyurethane sealer and finish.
  - 2. Gameline paint(s) shall be recommended by the finishing materials manufacturer, and must be compatible with the finish.
- E. Perimeter Base Robbins 3" x 4" ventilating type. (Specify black or brown)

## Part 3-EXECUTION

## **3.01 INSPECTION**

- A. Inspect concrete slab for proper tolerance and dryness, and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8" (3mm) in a 10' (3m). Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.
- B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.
- C. Subfloor shall be broom cleaned by general contractor.
- D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

## **3.02 INSTALLATION**

- A. Vapor Barrier
- 1. Install polyethylene with joints lapped a minimum of 6" (150mm) and turned up 4" (100mm) at the walls.
- B. Subfloor
  - 1. Install Robbins shock absorbing pads per manufacturer's recommendations.
  - 2. Install the lower subfloor perpendicular to the intended finish flooring direction. All joints shall be staggered 4' and spaced 1/4" (6mm) apart.
  - 3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
  - 4. Install Bleacher Blocking per manufacturer's recommendations.
  - 5. Install the upper subfloor diagonal to the lower subfloor panels staggering joints 4' and spacing <sup>1</sup>/<sub>4</sub>" (6mm) apart. Secure these panels using adhesive(Box X patteren) and 1" (25mm) staples placed 6" (150mm) On Center (O.C.) at panel perimeter and 12" (300mm) O.C. throughout interior.
- C. Maple Flooring
  - Machine nail maple finish flooring 10" to 12" (250mm to 300mm) O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Consult your local Robbins "Certified" contractor. Provide 2" (50mm) expansion voids at the perimeter and at all vertical obstructions. OPTION: (Specify or Delete) Expansion rows will be evenly distributed with each row of flooring, with each space not exceeding 1/64" (0.4mm).

## 3.03 FINISHING

- A. Sanding
  - 1. Sand per manufacturer's recommendations.
  - 2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
  - 3. Inspect entire area of floor to insure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.
  - 4. Vacuum and/or tack floor before first coat of seal.
  - 5. Floor should be clean and completely free of dirt and sanding dust.
- B. Finishing
  - 1. Gymnasiums (delete if not applicable)
    - a. Apply specified combination of seal, gameline paint, and finish in accordance with manufacturer's instructions.
    - b. Buff and vacuum and/or tack between each coat after it dries.

# **ROBBINS® BIO-CUSHION® CLASSIC**

- c. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.
- 2. Stages and Auditoriums (delete if not applicable)
  - a. Apply 2 or more coats of penetrating sealer, buffed in accordance with manufacturer's instructions in order to provide a low gloss, flat finish. Robbins recommends that stages be finished in walnut or darker colors for theatrical performance.

## **3.04 WALL BASE INSTALLATION**

1. Install Robbins vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corner.

## 3.05 CLEANING

1. Clean up all unused materials and debris and remove it from the premises.

Construction options are available to modify this system to the project design and budget. Contact your Regional Sales Manager or the local Authorized Dealer for more information.

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## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### 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. Resilient base.
  - 2. Resilient molding accessories.
  - 3. Rubber Stair Tread with Riser

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

## 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

### 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than [95 deg F (35 deg C)], in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 THERMOSET-RUBBER BASE (RB1)

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flexco
  - 2. Johnsonite; A Tarkett Company.
  - 3. Roppe.
- B. Product Standard: ASTM F 1861, Type TS (rubber, thermoset).
  - 1. Group: I (solid, homogeneous).
  - 2. Style:
    - a. Cove Base.
- C. Thickness:.125".
- D. Height: 4".
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As indicated by manufacturer's designations.

## RESILIENT BASE AND ACCESSORIES

# 2.2 VENT COVE WALL BASE (RB2)

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flexco
  - 2. Johnsonite; A Tarkett Company.
  - 3. Roppe.
- B. Product Standard: ASTM F 1861, Type TS (rubber, thermoset).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Style Vent Cove: Provide in areas with hardwood gymnasium floors..
- C. Minimum Thickness:.3135 inches.
- D. Height: 4 inches (102 mm).
- E. Lengths: Cut lengths 48 inches (1219 mm) long.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed.
- H. Colors and Patterns: As indicated by manufacturer's designations.
- 2.3 VINYL MOLDING ACCESSORY
  - A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - 1. Flexco
    - 2. Johnsonite; A Tarkett Company.
    - 3. Roppe.
  - B. Description: Vinyl cap for cove resilient flooring, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, transition strips.
  - C. Profile and Dimensions: As indicated.
  - D. Locations: Provide vinyl molding accessories in areas indicated.
  - E. Colors and Patterns: As selected by Architect from full range of industry colors.
- 2.4 Rubber Stair Treads with Riser
  - A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - 1. Flexco

- 2. Johnsonite; A Tarkett Company.
- 3. Roppe.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- C. Resilient Rubber Stair Tread:
  - 1. Manufactured from a homogeneous composition of 100% synthetic rubber.
  - 2. Complies with requirements for ASTM F 2169 Standard Specification for Resilient Stair Treads, Type TS, Class 1 and 2, Group 1 and 2.
  - 3. Hardness: ASTM D 2240 Not less than 85 Shore A.
  - 4. Abrasion Resistance: ASTM D 3389 less than 1 gram weight loss.
  - 5. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish- Coated Flooring of 0.6 or greater.
  - 6. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm<sup>2</sup> or greater, Class I.
  - 7. Integrated tread and riser.
  - 8. Visually Impaired treads meet ADA and are California Title 24 Accessibility requirements.
  - 9. Visually Impaired treads will have 2" wide co-extruded contrasting color insert or 2" wide contrasting color grit tape insert.
- D. Solid Color Rubber Integrated Stair Tread and Riser
  1. Hammered surface
- 2.5 INSTALLATION MATERIALS
  - A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
  - B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.
- 3.3 RESILIENT BASE INSTALLATION
  - A. Comply with manufacturer's written instructions for installing resilient base.
  - B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
  - C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
  - D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
  - E. Do not stretch resilient base during installation.
  - F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
  - G. Preformed Corners: Install preformed corners before installing straight pieces.
  - H. Job-Formed Corners:
    - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
      - a. Form without producing discoloration (whitening) at bends.
      - b. Follow manufactures written instructions for job formed outside corners.
    - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 12 inches in length.
      - a. Follow manufactures written instructions for job formed inside corners.

#### 3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.
- 3.5 CLEANING AND PROTECTION
  - A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
  - B. Perform the following operations immediately after completing resilient-product installation:
    - 1. Remove adhesive and other blemishes from exposed surfaces.
  - C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
  - D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096543 - LINOLEUM FLOORING

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

- 1. Section includes linoleum floor tile.
- B. Related Requirements:
  - 1. Section 090561 "Moisture Vapor Emission Control"
  - 2. Section 096513 "Resilient Base and Accessories"

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each different color and pattern of linoleum flooring required.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

#### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
- 1.7 QUALITY ASSURANCE
  - A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation.

- 1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups for flooring including resilient base and accessories.
    - a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern in locations indicated.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).
  - 1. Floor Tile: Store on flat surfaces.

## 1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring during the following time periods:
  - 1. 72 hours before installation.
  - 2. During installation.
  - 3. 72 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during flooring installation.
- D. Close spaces to traffic for 72 hours after flooring installation.
- E. Install flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

## LINOLEUM FLOORING

- 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Flooring shall comply with requirements of FloorScore certification.
- C. Low-Emitting Materials: Flooring system shall comply with the 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."
- 2.2 LINOLEUM FLOOR TILE (LF1, LF2, LF3, LF4, LF5, LF6)
  - A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - 1. Forbo Group
    - 2. Armstrong Commercial Flooring
    - 3. Johnsonite, A Tarkett Company
  - B. Linoleum Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing.
    - 1. Nominal Floor Tile Size: 20 by 20 inches (500 by 500 mm).
  - C. Thickness: 0.10 inch (2.5 mm).
  - D. Colors and Patterns: As indicated on drawings.
- 2.3 INSTALLATION MATERIALS
  - A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.
  - B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.
- PART 3 EXECUTION
- 3.1 EXAMINATION
  - A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
    - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.
  - B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.

- 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
- 2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
- 3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
- 4. Moisture Testing: Perform tests recommended by linoleum flooring manufacturer, but not less stringent than the following:
  - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lb of water/1000 sq. ft. in 24 hours.
  - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install flooring until it is the same temperature as space where it is to be installed.
  - 1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.
- 3.3 INSTALLATION, GENERAL
  - A. Comply with manufacturer's written instructions for installing flooring.
  - B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
  - C. Extend flooring into toe spaces, door reveals, closets, and similar openings.
  - D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.
  - E. Install flooring on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
  - F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
  - G. Unless otherwise directed by manufactures written instructions for installation of product and adhesive, Linoleum tile flooring material must always be placed into wet adhesive and rolled immediately with a 100 pound roller. Check for adhesive transfer frequently. There must be a wet transfer of adhesive to the material backing in order to achieve a secure bond. Always

carefully read and follow the instructions on the adhesive label regarding the use and application of the adhesive.

## 3.4 LINOLEUM FLOOR TILE INSTALLATION

- A. Lay out linoleum floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay floor tiles in pattern indicated square with room axis with grain running in same direction, and in pattern indicated.
- B. Match linoleum floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.
  - 1. Lay floor tiles in pattern of colors and sizes indicated.
- 3.5 CLEANING AND PROTECTION
  - A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.
  - B. Perform the following operations immediately after completing linoleum flooring installation:
    - 1. Remove adhesive and other blemishes from exposed surfaces.
    - 2. Sweep and vacuum surfaces thoroughly.
    - 3. Damp-mop surfaces to remove marks and soil.
  - C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
  - D. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 096813 - TILE CARPETING

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 modular, tufted carpet tile.
- B. Related Requirements:
  - 1. Section 090561 "Moisture Vapor Emission Control"
  - 2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.
  - 3. Section 096816 "Sheet Carpeting."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include installation recommendations for each type of substrate.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-(300-mm-)long Samples.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- B. Sample Warranty: For special warranty.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

- 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
- 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

## 1.6 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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Comply with CRI 104.
- 1.9 FIELD CONDITIONS
  - A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
  - B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
  - C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
  - D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

#### 1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber and delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE CPT1, CPT2, CPT3

- A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Shaw Industries, Inc.
  - 2. Mannington Commercial.
  - 3. Patcraft a division of Shaw Industries, Inc.
  - 4. Interface
  - 5. Mohawk Group
- B. Color: As indicated on drawings.
- C. Pattern: As indicated on drawings.
- D. Dye Method: 100% Solution dyed.
- E. Fiber Type: Eco Solution Q Nylon.
- F. Pile Characteristic: Pattern loop.
- G. Density: 16 oz./yd.
- H. Pile Thickness: .068 Inches
- I. Stitches: 9.8 stitches per in.
- J. Gage: 1/10 ends per inch
- K. Primary Backing/Backcoating: Manufacturer's standard composite materials.
- L. Secondary Backing: Manufacturer's standard material.
- M. Size: 24 by 24 inches (610 by 610 mm).
- N. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- O. Performance Characteristics: As follows:
  - 1. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
  - 2. Tuft Bind: Not less than 6.2 lbf (28 N) according to ASTM D 1335.
  - 3. Delamination: Not less than 3.5 lbf/in. (15 N/mm) according to ASTM D 3936.
  - 4. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
  - 5. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
  - 6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
  - 7. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
  - 8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## 2.2 CARPET TILE W01

- A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Shaw Industries, Inc.
  - 2. Mannington Commercial.
  - 3. Patcraft a division of Shaw Industries, Inc.
  - 4. Interface
  - 5. Mohawk Group
- B. Color: As indicated on drawings.
- C. Pattern: As indicated on drawings.
- D. Yarn System: 82.5% nylon; 17.5% polyester. Solution Dyed Nylon
- E. Fiber Type: Type 6.
- F. Pile Characteristic: Tufted, Multi-level loop.Hair Tile (Neddle punch).
- G. Density:  $5,739 \text{ oz/yd}^3$ .
- H. Pile Thickness: .391"
- I. Stitches: 11.3 stitches per in.
- J. Gage: 1/12 ends per inch
- K. Primary Backing/Backcoating: PVC-free well BAC Comfort Custom.
- L. Secondary Backing: Manufacturer's standard material.
- M. Size: 50 cm x 50cm.
- N. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- O. Performance Characteristics: As follows:
  - 1. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
  - 2. Tuft Bind: Not less than 6.2 lbf (28 N) according to ASTM D 1335.
  - 3. Delamination: Not less than 3.5 lbf/in. (15 N/mm) according to ASTM D 3936.
  - 4. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
  - 5. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
  - 6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
  - 7. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
  - 8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## 2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
  - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 096816 - SHEET CARPETING

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. Tufted carpet.
- B. Related Requirements:
  - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.
  - 2. Section 096813 "Tile Carpeting."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:
  - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet: 12-inch-(300-mm-)square Sample.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For carpet, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
    - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

### SHEET CARPETING

2. Precautions for cleaning materials and methods that could be detrimental to carpet.

#### 1.6 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. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).
- 1.7 QUALITY ASSURANCE
  - A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
  - B. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Comply with CRI 104.
- 1.9 FIELD CONDITIONS
  - A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
  - B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
  - C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
  - D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

### 1.10 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 TUFTED CARPET CP1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Mohawk Group.
  - 2. Shaw Contract
  - 3. Patcraft a Division of Shaw Inc.
  - 4. Mannington Mills, Inc.
  - 5. Interface
- B. Fiber Type: Eco Solution Q Nylon.
- C. Pile Characteristic: Multilevel-loop pile.
- D. Density: Average Density = 8,100
- E. Pile Thickness: .080 Inches
- F. Stitches: 11 per inch.
- G. Gage: 1/10 ends per inch
- H. Face Weight: 18 Ounces Per Square Yard
- I. Primary Backing: Manufacturer's standard material.
- J. Secondary Backing: Manufacturer's standard material.
- K. Width: 12' Width.
- L. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- M. Performance Characteristics: As follows:
  - 1. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
  - 2. Tuft Bind: Not less than 6.2 lbf (28 N) per ASTM D 1335.
  - 3. Delamination: Not less than 3.5 lbf/in. (15 N/mm) per ASTM D 3936.
  - 4. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
  - 5. Colorfastness to Light: Not less than 4 after60 AFU (AATCC fading units) per AATCC 16, Option E.
  - 6. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.

## 2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
  - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet.
  - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. For wood subfloors, verify the following:
  - 1. Underlayment over subfloor complies with requirements specified in Section 061000 "Rough Carpentry."
  - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### 3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
  - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
  - 2. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

#### 3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816
SECTION 097723 - FABRIC-WRAPPED 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 shop-fabricated, fabric-wrapped wall panels.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For fabric-wrapped wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.
  - 1. Include elevations showing panel sizes and direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products, prepared on Samples of size indicated below:
  - 1. Fabric: Full-width by approximately 36-inch-(900-mm-)long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
  - 2. Panel Edge: 12-inch-(300-mm-)long Sample(s) showing each edge profile, corner, and finish.
  - 3. Core Material: 12-inch-(300-mm-)square Sample at corner.
  - 4. Mounting Devices: Full-size Samples.
  - 5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fabric-wrapped wall panel, from manufacturer.
- B. Warranty: Sample of special warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fabric-wrapped wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

# 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide fabric-wrapped wall panels meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
  - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and fabric-wrapped, wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

### 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fabric-wrapped wall panels until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install fabric-wrapped wall panels until a permanent level of lighting is provided on surfaces to receive fabric-wrapped wall panels.
- C. Air-Quality Limitations: Protect fabric-wrapped wall panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of fabric-wrapped wall panels and actual dimensions of openings and penetrations by field measurements before fabrication.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fabric-wrapped wall panels that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Fabric sagging, distorting, or releasing from panel edge.
    - b. Warping of core.
  - 2. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

### 2.1 FABRIC-WRAPPED WALL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Acoustical Panel Systems (APS, Inc.)
  - 2. Armstrong World Industries
  - 3. AVL Systems, Inc.
  - 4. Conwed Designscape; an Owens Corning Company.
  - 5. MBI Products Company, Inc.
- B. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
  - 1. Basis-of-Design Product: Indicated on Drawings.
  - 2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
  - 3. Core: 100% Polyester Tackable Acoustical Substrate.
    - a. Core-Face Layer: Manufacturer's standard tackable, impact-resistant, high-density board.
  - 4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
  - 5. Edge Profile: Square.
  - 6. Corner Detail in Elevation: Square with continuous edge profile indicated.
  - 7. Reveals between Panels: Flush reveals as indicated on Drawings.
  - 8. Facing Material: As indicated on Drawings.
  - 9. Nominal Core Thickness: 1 inch.
  - 10. Panel Width: As indicated on Drawings.
  - 11. Panel Height: As indicated on Drawings.

### 2.2 FABRIC-WRAPPED WALL PANELS

- A. Basis of Design Products: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Acoustical Panel Systems (APS, Inc.)
  - 2. Armstrong World Industries
  - 3. AVL Systems, Inc.
  - 4. Conwed Designscape; an Owens Corning Company.
  - 5. MBI Products Company, Inc.
- B. Fabric-Wrapped Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
  - 1. Basis-of-Design Product: Indicated on Drawings.
  - 2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
  - 3. Core: 100% Polyester Tackable Acoustical Substrate.

- a. Core-Face Layer: Manufacturer's standard tackable, impact-resistant, high-density board.
- 4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
- 5. Edge Profile: Square.
- 6. Corner Detail in Elevation: Square with continuous edge profile indicated.
- 7. Reveals between Panels: Flush reveals as indicated on Drawings.
- 8. Facing Material: As indicated on Drawings.
- 9. Nominal Core Thickness: 1/2 inch.
- 10. Panel Width: As indicated on Drawings.
- 11. Panel Height: As indicated on Drawings.

## 2.3 MATERIALS

- A. Core Materials:
  - 1. 100% Polyester panel.
- B. Facing Material(F1, F2, F3, F4, F5, F6, F7, F8): Fabric from same dye lot; color and pattern as indicated by manufacturer's designations.
- C. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:
  - 1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of panel and the other part to substrate, designed to permit unit removal.

# 2.4 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Facing Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
  - 1. Square Corners: Tailor corners.
  - 2. Radius and Other Nonsquare Corners: Attach material so there are no seams or gathering of material.
  - 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- C. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch (1.6 mm) for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated panels, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped wall panels.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install fabric-wrapped wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with fabric-wrapped, wall panel manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.
- C. Align and level fabric pattern and grain among adjacent panels.

## 3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).
- B. Variation of Panel Joints from Hairline: Not more than 1/32 inch (0.79 mm) wide.

#### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097723

SECTION 098433 - SOUND-ABSORBING WALL UNITS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section includes shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
  - 1. Sound-diffusing wall panels.
- B. Related Sections:
  - 1. Section 097200 "Wall Coverings" for adhesively applied textile wall coverings and for coordinating requirements for fabric.
  - 2. Section 097713 "Stretched-Fabric Wall Systems" for site-upholstered systems for walls and for coordinating requirements for fabric.
  - 3. Section 097723 "Fabric-Wrapped Panels" for fabric-wrapped wall panels that are not required to be tested for acoustical performance and for coordinating requirements for fabric.

### 1.3 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of fabric facing, panel edge, core material, and mounting indicated.
- B. Samples for Verification: For the following products, prepared on Samples of size indicated below:
  - 1. Fabric: Full-width by approximately <u>36-inch-(900-mm-)</u> long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
  - 2. Panel Edge: 12-inch-(300-mm-)long Sample(s) showing each edge profile, corner, and finish.
  - 3. Core Material: 12-inch-(300-mm-)square Sample at corner.
  - 4. Mounting Devices: Full-size Samples.
  - 5. Assembled Panels: Approximately <u>36 by 36 inches</u> (900 by 900 mm), including joints and mounting methods.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of sound-absorbing wall unit, from manufacturer.
- B. Warranty: Sample of special warranty.

### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing wall units to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

### 1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.
- B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

### 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-absorbing wall units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to the following:
    - a. Acoustical performance.
    - b. Fabric sagging, distorting, or releasing from panel edge.
    - c. Warping of core.
  - 2. Warranty Period: Two years from date of Substantial Completion.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Armstrong
  - 2. Kinetics Noise Control, Inc.
  - 3. MBI Products Company, Inc.
  - 4. AVL Systems
  - 5. Conwed Designscape.
- C. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.
- 2.2 SOUND-ABSORBING WALL UNITS
  - A. Sound-Diffusing Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
    - 1. Panel Shape: Barrel As indicated on Drawings.
    - 2. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
    - 3. Core: fire-retardant formed plastic, prepared for required acoustical performance.
    - 4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
    - 5. Reveals between Panels: Flush reveals.
    - 6. Facing Material: F5 Guilford of Main Anchorage / Open House Asteroid.
    - 7. Acoustical Performance: Sound absorption NRC .80 according to ASTM C 423 for Type A mounting according to ASTM E 795.
    - 8. Panel Width: As indicated on Drawings.
    - 9. Panel Height: As indicated on Drawings.

# 2.3 MATERIALS

- A. Core Materials:
  - 1. Fire-Retardant Formed Plastic: Manufacturer's standard formed plastic with flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E 84.
- B. Facing Material F5: Fabric from same dye lot; color and patternas indicated on Drawings.
  - 1. Manufacturer: Guilford of Main.
  - 2. Product Line/Pattern: Anchorage
  - 3. Pattern Repeat: None.
  - 4. Style Number: 2335.
  - 5. Color: Asteroid 2053.
  - 6. Fiber Content: Recycled polyester.
  - 7. Width: 66 inches (1676 mm).
  - 8. Applied Treatments: Stain resistance.
- C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
  - 1. Splines: Manufacturer's standard concealed metal or plastic splines that engage the kerfed edges of the unit, with other moldings and trim for interior corners, exterior corners, and exposed edges, with factory-applied finish on exposed items.
  - 2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

## 2.4 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
  - 1. Square Corners: Tailor corners. Heat seal vinyl fabric seams at corners.
  - 2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
  - 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align and level fabric pattern and grain among adjacent units.

## 3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).
- B. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) wide.

### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

# SECTION 098436 - SOUND-ABSORBING CEILING UNITS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:
  - 1. Sound-diffusing panels.
- B. Related Requirements:
  - 1. Section 097200 "Wall Coverings" for adhesively applied textile wall coverings and for coordinated requirements for fabric.
  - 2. Section 095443 "Stretched-Fabric Ceiling Systems" for site-upholstered systems for ceilings and for coordinated requirements for fabric.
  - 3. Section 095446 "Fabric-Wrapped Ceiling Panels" for shop-fabricated, fabric-wrapped ceiling panels that are not required to be tested for acoustical performance and for coordinated requirements for fabric.
  - 4. Section 098433 "Sound-Absorbing Wall Units" for shop-fabricated fabric-wrapped wall panels tested for acoustical performance and for coordinated requirements for fabric.

#### 1.3 DEFINITIONS

- A. NRC: Noise reduction coefficient.
- B. SAA: Sound absorption average.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, mounting, material descriptions, dimensions of individual components and profiles, and finishes for sound-absorbing ceiling units.
  - 2. Include furnished specialties and accessories.
- B. Samples for Verification: For the following products:
  - 1. Fabric: Full-width by approximately 36-inch-(900-mm-) long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.

- 2. Panel Edge: 12-inch-(300-mm-)long Sample(s) showing each edge profile, corner, and finish.
- 3. Core Material: 12-inch-(300-mm-)square Sample at corner.
- 4. Mounting Devices: Full-size Samples.
- 5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.
- 1.5 INFORMATIONAL SUBMITTALS
  - A. Product Certificates: For each type of sound-absorbing ceiling unit.
  - B. Sample Warranty: For special warranty.

### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-absorbing ceiling units to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal recommendations.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and sound-absorbing ceiling unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install sound-absorbing ceiling units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install sound-absorbing ceiling units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect sound-absorbing ceiling units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of sound-absorbing ceiling units and actual dimensions of openings and penetrations by field measurements before fabrication.

#### 1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sound-absorbing ceiling units that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
  - a. Acoustical performance.
  - b. Fabric sagging, distorting, or releasing from panel edge.
  - c. Warping of core.
- 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Armstrong
  - 2. Kinetics Noise Control, Inc.
  - 3. MBI Products Company, Inc.
  - 4. AVL Systems
  - 5. Conwed Designscape.
- C. Source Limitations: Obtain sound-absorbing ceiling units from single source from single manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide sound-absorbing ceiling units meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: Comply with ASTM E 84; 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. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

### 2.3 SOUND-ABSORBING CEILING UNITS

- A. Sound-Diffusing Ceiling Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
  - 1. Basis-of-Design Product: Armstrong.
  - 2. Panel Shape: Barrel.
  - 3. Mounting: Back mounted with manufacturer's standard suspension system, secured to substrate.
  - 4. Core: Manufacturer's standard, prepared for required acoustical performance.
  - 5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
  - 6. Facing Material: As indicated on Drawings.

- 7. Acoustical Performance: Sound absorption NRC.08 of according to ASTM C 423 for Type A mounting according to ASTM E 795.
- 8. Panel Width: 48 inches.
- 9. Panel Height: 48 inches.

## 2.4 MATERIALS

- A. Core Materials: Manufacturer's standard.
- B. Facing Material F6: Fabric from same dye lot; color and patternas indicated on Drawings.
  - 1. Manufacturer: Guilford of Maine.
  - 2. Product Line/Pattern: Anchorage.
  - 3. Pattern Repeat: None.
  - 4. Style Number: 2335.
  - 5. Color: White 2664.
  - 6. Fiber Content: Recycled polyester.
  - 7. Width: 66 inches (1676 mm).
  - 8. Applied Treatments: Stain resistance.
  - 9. Light Reflectance: Average value not less than 0.75 when tested according to ASTM E 1477.
- C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit.

## 2.5 FABRICATION

- A. General: Use manufacturer's standard construction except as otherwise indicated, with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Glass-Fiber Board and Mineral-Fiber Board Cores: Chemically harden core edges and areas of core where mounting devices are attached.
- C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
  - 1. Square Corners: Tailor corners. Heat seal vinyl fabric seams at corners.
  - 2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
  - 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches adjacent units.
- D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
  - 1. Thickness.
  - 2. Edge straightness.
  - 3. Overall length and width.
  - 4. Squareness from corner to corner.
  - 5. Chords, radii, and diameters.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing ceiling units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install sound-absorbing ceiling units in locations indicated with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with sound-absorbing ceiling unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent units.

## 3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch (1.6 mm).
- B. Variation from Level or Slope: Plus or minus 1/16 inch (1.6 mm).
- C. Variation of Panel Joints from Hairline: Not more than 1/16 inch (1.6 mm) wide.

## 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098436

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 surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Concrete masonry units (CMUs).
  - 3. Steel and iron.
  - 4. Galvanized metal.
  - 5. Gypsum board.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing", Section 051213 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
  - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section 055113 "Metal Pan Stairs" for shop priming metal pan stairs.
  - 4. Section 055116 "Metal Floor Plate Stairs" for shop priming metal floor plate stairs.
  - 5. Section 055119 "Metal Grating Stairs" for shop priming metal grating stairs.
  - 6. Section 055213 "Pipe and Tube Railings" for shop priming, painting pipe and tube railings.
  - 7. Section 055313 "Bar Gratings", Section 055316 "Plank Gratings", Section 055319 "Expanded Metal Gratings" for shop priming metal gratings.
  - 8. Section 099600 "High-Performance Coatings" for tile-like coatings.
  - 9. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

#### 1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Step coats on Samples 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 paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

# 1.5 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. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
- 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 (7 deg C).
    - 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 paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg
  F (3 deg C) above the dew point; or to damp or wet surfaces.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. <u>Basis-of-Design Products</u>: Subject to compliance with requirements, provide products indicated in Interior Painting Schedule or comparable product by one of the following:
  - 1. Benjamin Moore
  - 2. PPG Architectural Coatings Inc.
  - 3. Sherwin-Williams

# 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. 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.
- C. Colors: As indicated in a color schedule.

## 2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints 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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMUs): 12 percent.
  - 3. 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 in "MPI Architectural Painting Specification Manual" 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.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. 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 2.

- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. 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 paints.

## 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in occupied spaces:
    - a. Uninsulated metal piping.
    - b. Pipe hangers and supports.
    - c. Metal conduit.
    - d. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - e. Other items as directed by Architect.
  - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

## 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 paint for dry film thickness.

- 1. Contractor shall touch up and restore painted surfaces damaged by testing.
- 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint 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 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.

## 3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Latex System MPI INT 3.1A:
    - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
    - b. Prime Coat: Latex, interior, matching topcoat.
    - c. Intermediate Coat: Latex, interior, matching topcoat.
    - d. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
- B. Concrete Substrates, Traffic Surfaces:
  - 1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:
    - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
    - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
  - 2. Epoxy System MPI INT 3.2C:
    - a. Prime Coat: Epoxy, matching topcoat thin by 20%.
    - b. Intermediate Coat: Epoxy, matching topcoat.
    - c. Topcoat: Epoxy, semi-gloss.
      - 1) Basis of Design: S-W "Macropoxy 646".
- C. CMU Substrates:
  - 1. Latex System MPI INT 4.2A:
    - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

- 2. Water-Based Epoxy Coating System:
  - a. Block Filler: Epoxy Block filler, MPI #116.
  - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
  - c. Topcoat: Water based epoxy MPI #115.
  - d. Topcoat: Water based epoxy MPI #115.
- D. Steel Substrates:
  - 1. Latex over Shop-Applied Quick-Drying Shop Primer System MPI INT 5.1X:
    - a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
  - 2. Water-Based Dry-Fall over Shop-Applied Quick-Drying Shop Primer System MPI INT 5.1CCC:
    - a. Prime Coat: Primer, quick dry, for shop application, MPI #275.
    - b. Topcoat: Dry fall, latex, flat, MPI #118.
  - 3. Alkyd System MPI INT 5.1E:
    - a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
    - b. Intermediate Coat: Alkyd, interior, matching topcoat.
    - c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), MPI #47.
  - 4. Water Based Epoxy:
    - a. Prime Coat: Latex primer.
    - b. Intermediate and Topcoat: Water based epoxy.
- E. Galvanized-Metal Substrates:
  - 1. Latex System MPI INT 5.3J:
    - a. Prime Coat: Primer, galvanized, water based, MPI #134.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
  - 2. Water-Based Dry-Fall System MPI INT 5.3H:
    - a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
    - b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), MPI #133.
  - 3. Alkyd over Cementitious Primer System MPI INT 5.3C:
    - a. Prime Coat: Primer, galvanized, cementitious, MPI #26.
    - b. Intermediate Coat: Alkyd, interior, matching topcoat.
    - c. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), MPI #47.
- F. Gypsum Board Substrates:

- 1. Latex over Latex Sealer System MPI INT 9.2A:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Prime Coat: Latex, interior, matching topcoat.
  - c. Intermediate Coat: Latex, interior, matching topcoat.
  - d. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.
- 2. Alkyd over Latex Sealer System MPI INT 9.2C:
  - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
  - b. Intermediate Coat: Alkyd, interior, matching topcoat.
  - c. Topcoat: Alkyd, interior (MPI Gloss Level 3), MPI #51.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Visual display board assemblies.
- B. Related Requirements:
  - 1. Section 097723 "Fabric-Wrapped Panels" for tackable, fabric-covered panels mounted on walls.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
  - 2. Include electrical characteristics for motorized units.
- B. Samples for Verification: For each type of visual display unit indicated.
  - 1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
  - 2. Trim: 6-inch-(150-mm-)long sections of each trim profile.
  - 3. Display Rail: 6-inch-(150-mm-)long section of each type.
  - 4. 6-inch-(152-mm-)long sections.
  - 5. Accessories: Full-size Sample of each type of accessory.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.
- B. Sample Warranties: For special warranties.

# 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

### 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

### 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

#### 1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: Life of the building.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Subject to compliance, provide products by one of the following:
  - 1. A-1 Visual Systems
  - 2. Architectural School Products, Ltd.
  - 3. Best Rite Manufacturing; a brand division of MooreCo., Inc.
  - 4. Claridge Products and Equipment, Inc.
  - 5. Marsh Industries, Inc.; Visual Products Group

## VISUAL DISPLAY UNITS

6. Platinum Visual Systems; a division of ABC School Equipment, Inc.

# 2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- 2.3 VISUAL DISPLAY BOARD ASSEMBLY: MB4, MB5, MB6 & MB8, TB4, TB6, MT4, MT8, MT8= & MT10.
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - B. Visual Display Board Assembly: factory fabricated.
    - 1. Assembly: markerboard and tackboard.
    - 2. Corners: Square.
    - 3. Width: As indicated on Drawings.
    - 4. Height: As indicated on Drawings.
    - 5. Mounting Method: Direct to wall.
  - C. Markerboard Panel: Magnetic Porcelain-enamel-faced markerboard panel on core indicated.
    - 1. Color: White.
  - D. Tackboard Panel: Plastic-impregnated-cork tackboard panel on core indicated.
    - 1. Color and Pattern: As selected by Architect from full range of industry colors.
  - E. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-(1.57-mm-)thick, extruded aluminum; standard size and shape.
    - 1. Aluminum Finish: Clear anodic finish.
  - F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
  - G. Combination Assemblies: Provide H-trim between abutting sections of visual display panels.
  - H. Chalktray: Manufacturer's standard; continuous.
    - 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
  - I. Display Rail (at Markerboards only): Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
    - 1. Size: 1 inch (25 mm) high by full length of visual display unit.
    - 2. Metal Map Hooks: Two map hooks for every 48 inches (1200 mm) of display rail or fraction thereof.

- 3. Metal Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches (1200 mm) of display rail or fraction thereof.
- 4. Metal Flag Holder: One for each room.
- 5. Tackboard Insert Color: As selected by Architect from full range of industry colors.
- 6. Aluminum Color: Match finish of visual display assembly trim.
- J. Special-Purpose Graphics: Fuse or paint music staff lines graphic onto surface of porcelainenamel visual display unit, in locations indicated.

## 2.4 MARKERBOARD PANELS

- A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
  - 1. Medium-Density Fiberboard Core: 7/16 inch (11 mm) thick; with manufacturer's standard moisture-barrier backing.
  - 2. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

### 2.5 TACKBOARD PANELS

- A. Tackboard Panels:
  - 1. Facing: plastic-impregnated cork.
  - 2. Core: Manufacturer's standard.

## 2.6 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
- C. Particleboard: ANSI A208.1, Grade M-1.
- D. Medium-Density Fiberboard: ANSI A208.2.
- E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- F. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

# 2.7 GENERAL FINISH REQUIREMENTS

- 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 unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### 2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

# 3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

- B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
  - 1. Mounting Height for Grades K through 2: 24 inches (610 mm) above finished floor to top of chalktray.
  - 2. Mounting Height for Grades 3 through 6: 28 inches (711 mm) above finished floor to top of chalktray.
  - 3. Mounting Height in Rooms serving all grades: 28 inches (711 mm) above finished floor to top of chalktray.
- D. Display Rails: Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
  - 1. Mounting Height: Mount at top of Visual Display Board.
- 3.4 CLEANING AND PROTECTION
  - A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
  - B. Touch up factory-applied finishes to restore damaged or soiled areas.
  - C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101423 – PANEL SIGNAGE

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Panel signs.

#### 1.3 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Qualification Data: For Installer and fabricator.
- D. Maintenance Data: For signs to include in maintenance manuals.
- E. Warranty: Special warranty specified in this Section.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An approved by manufacturer
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful inservice performance.

- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

# 1.6 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

# 1.7 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metal and polymer finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image colors and sign lamination.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for each sign is based on "In-touch" Interior Series by ASI Sign Systems. Subject to compliance with requirements, provide either named products or a comparable product:

## 2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, sizes and details of construction.
  - 1. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
- B. Face Panels: Face radius varies with panel width panel ends precisely radiused to 2.6 mm to receive frame components with attachment perforations at exact modular intervals.

- C. Frame Components: Injection molded polycarbonate support ribs. Black anodized aluminum vertical supports.
- D. Graphic Panels: High-strength, cold rolled 0.75 mm aluminum alloy.
- E. Graphic Content Style: Provide sign copy that complies with requirements indicated below:
  - 1. Size: 6" x 6".
  - 2. Font: Helvetica Regular.
  - 3. Text Height: 1".
  - 4. Graphic Method: LTV Series vinyl graphics.
  - 5. Panel Finish: As selected by Architect from manufacturer's full range.
  - 6. Graphics Color: As selected by Architect from manufacturer's full range.
  - 7. Quantity: 26. Typical signage required:
    - a. Storage (3)
    - b. Office (1)
    - c. Work Room (1)
    - d. Mechanical (1)
    - e. Boys (ADA) (2)
    - f. Girls (ADA) (2)
    - g. Restroom (2)
    - h. Classroom (13). Each will have unique name/identifier.
    - i. Activity Room (1)
- F. Back Panel: Where sign is indicated to be mounted on a glass sidelight, provide a matching back panel on opposite side of glass.

## 2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.4 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
  - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
  - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
  - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
  - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

## 2.5 FINISHES, GENERAL

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

#### 2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Verify all signage locations with Architect before installation.
- B. Projected of Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

## 3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101423

# SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

## 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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

# B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for supports that attach floor-and-ceiling-anchored compartments to overhead structural system.
- 2. Overhead support of floor-and-ceiling-anchored compartments.
- 3. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

# 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 toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.
  - 2. Show locations of cutouts for compartment-mounted toilet accessories.
  - 3. Show locations of centerlines of toilet fixtures.
  - 4. Show locations of floor drains.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
  - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6inch- (152-mm-) square Samples of same thickness and material indicated for Work.
  - 2. Each type of hardware and accessory.

### 1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in 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. Door Hinges: Three hinge(s) with associated fasteners.
  - 2. Latch and Keeper: Three latch(es) and keeper(s) with associated fasteners.
  - 3. Door Bumper: Two door bumper(s) with associated fasteners.
  - 4. Door Pull: Two door pull(s) with associated fasteners.
  - 5. Fasteners: Ten fasteners of each size and type.

### 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 200 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

#### 2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. <u>Manufacturers:</u> Subject to compliance with requirements available manufacturers offering products that may be incorporated into the work included, but are not limited to the following:
- B. Basis of Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:
  - 1. Scanton Products, Inc.
  - 2. Accurate Partitions
  - 3. General Partitions
- C. Toilet-Enclosure Style: Floor and ceiling anchored.
- D. Urinal-Screen Style: Wall hung.

- E. Door, Panel, Screen, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.
- F. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.
- G. Brackets (Fittings):
  - 1. Full-Height (Continuous) Type: Manufacturer's standard design; aluminum.
- H. Phenolic-Panel Finish:
  - 1. Facing Sheet Finish: One color and pattern in each room.
  - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard.
  - 3. Edge Color: Through-color matching facing sheet color.

# 2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's minimum 0.062-inch-(1.59-mm-)thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
  - 2. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.

# 2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-(610-mm-)wide, in-swinging doors for standard toilet compartments and 36-inch-(914-mm-)wide, out-swinging doors with a minimum 32-inch-(813-mm-)wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch (13 mm).
    - b. Panels and Walls: 1 inch (25 mm).
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

## 3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17

# SECTION 102123 - CUBICLE CURTAINS AND TRACKS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Curtain tracks and curtain carriers.
  - 2. Cubicle curtains.

#### 1.3 SUBMITTALS

- A. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-testresponse characteristics for each type of curtain fabric indicated.
  - 1. Include data on each type of applied curtain treatment.
- B. Samples for Initial Selection: For each type of curtain material indicated.
- C. Samples for Verification: For each type of product required, prepared on Samples of size indicated below.
  - 1. Curtain Track: Not less than 4 inches (102 mm) long.
  - 2. Curtain Carrier: Full-size unit.
- D. Operation and Maintenance Data: For track, and hardware to include in operation and maintenance manuals.

#### PART 2 - PRODUCTS

#### 2.1 CURTAIN TRACKS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. General Cubicle Company, Inc.
  - 2. Imperial Fastener Company, Inc.
  - 3. InPro Corporation
  - 4. Salsbury Industries

- B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high (32 mm wide by 19 mm high); with minimum wall thickness of 0.062 inch (1.57 mm).
  - 1. Curved Track: Factory-fabricated, 18-inch- (457-mm-) radius bends.
  - 2. Finish: Clear anodized.
- C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
- D. Curtain Carriers: Two nylon rollers and nylon axle with aluminum hook.
- E. Exposed Fasteners: Stainless steel.
- F. Concealed Fasteners: Hot-dip galvanized.

## 2.2 CURTAINS

- A. Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.
  - 1. Width: As required.
  - 2. Color: As selected by Architect from manufacturer's full range.
- B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches (152 mm) o.c.; machined into top hem.
- C. Mesh Top: Not less than 22-inch (559 m) high mesh top.1. Mesh: No. 50.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Install tracks level and plumb, according to manufacturer's written instructions.
- B. Up to 16 feet (4.9 m) in length, provide track fabricated from 1 continuous length.
  - 1. Curtain Track Mounting: Surface.
- C. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches (610 mm). Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:

- 1. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
- D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
- E. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
- F. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

## 3.3 PROTECTION

A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

# SECTION 102239 – FOLDING PANEL PARTITIONS

### 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. Manually operated, acoustical panel partitions.
- B. Related Sections:
  - 1. Division 05 Section "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
  - 2. Division 09 Section "Gypsum Board" for sound barrier construction above the ceiling at track.
  - 3. Divisions 26 and 27 Sections for electrical service and connections for motor operators, controls, and limit switches; and for system disconnect switches.

## 1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
  - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
  - 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.
  - 3. Acoustical Performance Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for Type I Partition: 50.

### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, numbered panel installation sequence, and attachments to other work.
  - 1. For installed products indicated to comply with design loads, include structural analysis data for attachments, signed and sealed by the qualified professional engineer responsible for their preparation.
  - 2. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing indicated.
  - 1. Include similar Samples of accessories involving color selection.
- D. Setting Drawings: For embedded items and cutouts required in other work, including supportbeam, mounting-hole template.
- E. Product Certificates: For each type of operable panel partition, from manufacturer.
- F. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
  - 2. Seals, hardware, track, carriers, and other operating components.

#### 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

#### 1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of operable panel partition openings by field measurements before fabrication.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of operable panel partitions.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
- B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.

## 2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Operable acoustical panel partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Foldoor, Holcomb & Hoke Mfg., Inc.
    - b. Panelfold, Inc.
    - c. Kwik Wall Company.
  - 2. Basis-of-Design Product:
    - a. Modernfold, Inc.; a DORMA Group Company, Acousti-seal, Model No. 931.
- B. Panel Operation: Manually operated, paired panel.
- C. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight

hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
  - 1. Panel Width: Standard widths.
- E. STC: Not less than 50.
- F. Panel Weight: 8 lb/sq. ft. (40 kg/sq. m) maximum.
- G. Panel Thickness: Not less than 3 inches (75 mm).
- H. Panel Closure: Manufacturer's standard.
  - 1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
  - 2. Final Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
- I. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
  - 1. Hinges: Manufacturer's standard.

## 2.3 SEALS

- A. General: Provide types of seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:
  - 1. Manufacturer's standard seals.
  - 2. Seals made from materials and in profiles that minimize sound leakage.
  - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Interlocking Sound Seals Between Panels: Roll-formed astragals, with reversible tongue and groove configuration in each panel edge, for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.
- C. Horizontal Top Seals: Continuous contact extruded vinyl bulb shaped with pairs of noncontacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
- D. Horizontal Bottom Seals: Modernfold 1A2 bottom seal. Automatic operable seals providing nominal 2 inch (51 mm) operating clearance with an operating range of +0/50 inch (13 mm) to -1.50 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

## 2.4 FINISH FACING

A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate

backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

- 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with no gaps or overlaps. Horizontal butted edges, seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
- 2. Match facing pattern 72 inches (1830 mm) above finished floor.
- B. Vinyl Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinylcoated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.
  - 1. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
  - 2. Color/Pattern: As selected by Architect from manufacturer's standard range.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

## 2.5 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
  - 1. Panel Guide: Aluminum; finished with factory-applied, decorative, protective finish.
  - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

## 2.6 OPTIONS

- A. Work Surfaces shall be as indicated on drawings:
  - 1. Markerboard: White enamel on steel, bonded to the face of the panel with horizontal trim without exposed fasteners. Trim Is not acceptable on vertical edges to provide uninterrupted work surface.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

#### 3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware, electric operator, and other moving parts.
- B. Adjust pass doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

## 3.4 FIELD QUALITY CONTROL

- A. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.
- B. NIC Testing: Owner may engage a qualified testing agency to perform tests and inspections.
- C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
- E. Repair or replace operable panel partitions that do not comply with requirements.

- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.
- G. Prepare test and inspection reports.

## 3.5 CLEANING

A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

## 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

# SECTION 102600 - WALL AND DOOR PROTECTION

## 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. Corner guards.
  - 2. Impact-resistant wall panels.

#### 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, fire-testresponse characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
  - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below. Include Samples of accent strips to verify color selected.
  - 1. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.
  - 2. Handrails: 12 inches (300 mm) long. Include examples of joinery, corners, and field splices.
  - 3. Impact-Resistant Wall Panel: 6 by 6 inches (150 by 150 mm) square.
- D. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
- E. Warranty: Sample of special warranty.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impactresistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
  - 2. Keep plastic sheet material out of direct sunlight.
  - 3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard handrail covers in a horizontal position.

### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.
- B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
  - a. Structural failures.
  - b. Deterioration of plastic and other materials beyond normal use.
- 2. Warranty Period: Five years from date of Substantial Completion.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot-long units.
  - 2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- long units.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Extruded Rigid Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, highimpact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.
  - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
  - 2. Chemical and Stain Resistance: Tested according to ASTM D 543
  - 3. Self-extinguishing when tested according to ASTM D 635.
  - 4. Flame-Spread Index: 25 or less.
  - 5. Smoke-Developed Index: 450 or less.
- B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.
- C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.
- D. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- E. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

## 2.2 CORNER GUARDS

- A. Flush-Mounted, Resilient, Plastic Corner Guards : Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface, installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.
  - 1. Available Manufacturer:
    - a. Pawling Corporation
    - b. Construction Specialties, Inc.
    - c. IPC Door and Wall Protection Systems
  - 2. Cover: Extruded rigid plastic, minimum 0.078-inch wall thickness;
    - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius
    - b. Height: As indicated.
    - c. Color and Texture: As selected from manufacturer's full range.
  - 3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.

## 2.3 END-WALL GUARDS

- A. Flush-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover that is flush with adjacent wall surface and that covers the entire end of wall, installed over continuous retainer; including mounting hardware.
  - 1. Available Manufacturers:
    - a. Pawling Corporation.
    - b. Construction Specialties, Inc.
    - c. IPC Door and Wall Protection Systems
  - 2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm)] wall thickness;
    - a. Profile: Nominal 2-inch- (50-mm-) long leg and 1/4-inch (6-mm) corner radius]
    - b. Height: As indicated
    - c. Color and Texture: As selected from manufacturer's full range.
  - 3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
  - 4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

## 2.4 IMPACT-RESISTANT PANEL 1" THICK

- A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
  - 1. Available Manufacturers:
    - a. Pawling Corporation.
    - b. Construction Specialties, Inc.
    - c. IPC Door and Wall Protection Systems
  - 2. Size: 48 by 96 inches for sheet; 48 by 120 inches for roll
  - 3. Sheet Thickness: 0.040 inch.
  - 4. Color and Texture: As selected from manufacturer's full range.

- 5. Height: As indicated on drawings
- 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
- 7. Mounting: Adhesive.

## 2.5 IMPACT-RESISTANT WALL PANEL 3/8" THICK

- A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.
  - 1. Available Manufacturers:
    - a. Pawling Corporation.
    - b. Construction Specialties, Inc.
    - c. IPC Door and Wall Protection Systems
  - 2. Size: 48 by 96 inches for sheet; 48 by 120 inches for roll
  - 3. Sheet Thickness: 0.040 inch.
  - 4. Color and Texture: As selected from manufacturer's full range.
  - 5. Height: As indicated on drawings
  - 6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
  - 7. Mounting: Adhesive.

## 2.6 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
  - 1. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.
  - 2. Sheet Thickness of 0.060 Inch (1.5 mm): 36-inch (914-mm) radius.
- C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

- 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

## 3.3 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  - a. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
  - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
    - a. Provide anchoring devices to withstand imposed loads.
    - b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
    - c. Adjust end and top caps as required to ensure tight seams.
- B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

## 3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to Toilet Accessory Schedule in the construction documents.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Public-use washroom accessories.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
  - 6. Include electrical wiring diagrams.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated on Drawings.
  - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency and marked for intended location and application.

### 1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
- C. Coordinate electrical requirements.

#### 1.6 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359inch (0.9-mm) minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamperand-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

#### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide the named product by the following manufacturers:

- 1. Toilet Accessories
  - a. A & J Washroom Accessories, Inc.
  - b. American Specialties, Inc.
  - c. Bobrick Washroom Equipment, Inc.
  - d. Bradley Corporation.
  - e. General Accessory Manufacturing Co. (GAMCO).
  - f. McKinney/Parker Washroom Accessories Corp.
- B. Refer to items listed in the drawings and finish specifications.

## 2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Examine rough-in of electrical systems/components to verify actual locations of connections before installation.
- B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- C. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

## 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

## SECTION 104413 - FIRE EXTINGUISHER CABINETS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Sections:
  - 1. Division 10 Section "Fire Extinguishers."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
  - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Initial Selection: For each type of fire protection cabinet indicated.

## 1.4 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

1.

- B. Stainless Steel: ASTM A 666, Type 304.
  - 1. Finish: No. 4 directional satin finish.

## 2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - Products: Subject to compliance with requirements, provide one of the following:
    - a. J. L. Industries, Inc., a division of Activar Construction Products Group.
    - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
    - c. Larsen's Manufacturing Company.
    - d. Modern Metal Products, Division of Technico Inc.
    - e. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Steel sheet.
- D. Recessed Cabinet:
  - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Cabinet Trim Material: Stainless steel sheet.
- F. Door Material: Stainless steel sheet.
- G. Door Style: Flush opaque panel, frameless, with no exposed hinges.
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide projecting door pull and friction latch.
  - 2. Provide concealed hinge permitting door to open 180 degrees.
- I. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
    - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Pressure-sensitive vinyl letters.
      - 3) Lettering Color: Black.
      - 4) Orientation: Vertical.

## 2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

#### 2.4 GENERAL FINISH REQUIREMENTS

- 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 of fire protection cabinets 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.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

## 3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below.
  - 1. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

## 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factoryfinished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

SECTION 104416 - FIRE EXTINGUISHERS

### 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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
  - 1. Division 10 Section "Fire Extinguisher Cabinets."

#### 1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

#### 1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

## PART 2 - PRODUCTS

#### 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet, mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.

- f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
- g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
- h. Larsen's Manufacturing Company.
- i. Moon-American.
- j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
- k. Potter Roemer LLC.
- I. Pyro-Chem; Tyco Safety Products.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

# 2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Larsen's Manufacturing Company.
    - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

SECTION 105113 - METAL LOCKERS

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. Welded lockers.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Show locker trim and accessories.
  - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Samples for Verification: For the following products, in manufacturer's standard size:
  - 1. Lockers and equipment.
- 1.4 INFORMATIONAL SUBMITTALS
  - A. Sample Warranty: For special warranty.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

### 1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

#### 1.8 COORDINATION

- A. Coordinate sizes and locations of bases for metal athletic lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of latches and other door hardware.
  - 2. Damage from deliberate destruction and vandalism is excluded.
  - 3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

### 2.3 WELDED LOCKERS

- A. Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
  - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
  - 2. Door Style: Vented panel as follows:

- a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier lockers.
- B. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
  - 1. Tops, Bottoms, and Sides: 0.060-inch (1.52-mm) nominal thickness.
  - 2. Backs: 0.048-inch (1.21-mm) nominal thickness.
  - 3. Dimensions:
    - a. 12w, 15d, 72h
- C. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
- D. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
  - 1. Continuous Hinges: Manufacturer's standard, steel, full height.
- E. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
  - 1. Single-Point Latching: Nonmoving latch hook designed to engage bolt of built-in combination or cylinder lock.
    - a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
- F. Locks: Combination padlocks.
- G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.
- H. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- I. Continuous Zee Base: Fabricated from, manufacturer's standard thickness, but not less than 0.060-inch (1.52-mm) nominal-thickness steel sheet.
  - 1. Height: 4 inches (102 mm).
- J. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
  - 1. Closures: Vertical-end type.
- K. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
- L. Materials:

- 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- 2. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
- M. Finish: Baked enamel or powder coat.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.4 LOCKS

A. Combination Padlocks: Provided by Owner.

## 2.5 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
  - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
  - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
  - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
  - 2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- E. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
  - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
  - 1. Sloping-top corner fillers, mitered.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slipjoint filler angle formed to receive filler panel.

- I. Boxed End Panels: Fabricated with 1-inch-(25-mm-)wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

#### 2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
  - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
  - 3. Anchor back-to-back metal lockers to floor.
- B. Welded Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
  - 1. Attach hooks with at least two fasteners.
  - 2. Attach door locks on doors using security-type fasteners.
  - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
    - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

- b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach recess trim to recessed metal lockers with concealed clips.
  - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
  - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
  - 4. Attach boxed end panels using concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
  - 5. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
- E. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

## 3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

# 3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

## SECTION 105300 – ALUMINUM WALKWAY COVER

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Division 1 specifications shall apply to work specified in the section.
- B. Section 123000 ALTERNATES
- C. Section 033000 CAST IN PLACE CONCRETE
- D. Division 22 Plumbing

## 1.2 REFERENCES

- A. International Building Code 2006
- B. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures
- C. Aluminum Design Manual 2005
- D. Local governing codes and standards for site location
- 1.3 GENERAL DESCRIPTION OF WORK
  - A. Work in this section shall include design, fabrication, and installation of aluminum cantilevered canopy as described on "Sheet A12.1 – Alternate #4 Pre-K Canopy". All work shall be in accordance with the shop drawings and this specification section.
- 1.4 SUBMITTALS
  - A. Shop Drawings Submit complete shop drawings including:
    - 1) Overall canopy layout dimensions
    - 2) Cut section details including elevation, bent layout dimensions, and connection details
    - 3) Flashing details pertaining to aluminum canopy
    - 4) Concrete footing and/or canopy anchorage details
  - B. Product Data Submit manufacturer's product information, specifications, and installation instructions for the aluminum canopy.
  - C. Samples Submit color selection samples of actual coated aluminum material or actual anodized aluminum material.
  - D. Certification Provide letter of compliance certifying that the proposed canopy design and layout meets or exceeds all applicable loadings (ex: wind load, rain live load, dead load, snow load) for the job location (city & state) in accordance with IBC 2006 and ASCE 7-05.

# 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years experience in design, fabrication, and production of aluminum protective covers.
- B. Components shall be assembled in shop to greatest extent possible to minimize field assembly.
- C. Aluminum protective cover, including material and workmanship, shall be warranted from defects for a period of one year from date of completion of aluminum protective cover installation.

## PART 2 - PRODUCTS AND MATERIALS

- 2.1 ACCEPTABLE MANUFACTURERS
  - A. 1) Mitchell Metals, LLC
    2) Rusco Custom Canopies, SW Brown Company
    3) Perfection Architectural Systems, INC
  - B. Equivalent systems by other manufacturers will be approved for substitution by addendum if the following conditions are met:
    - 1) Other manufacturers must have submitted requested information and have been qualified to bid no less than 10 days prior to bid closing date.
    - 2) Manufacturer must submit complete company literature and information to the architect for review
    - 3) Manufacturer must submit complete proposed canopy system details, including sizes and strength values of all members to be used.
- 2.2 DESIGN & ASSEMBLY
  - A. Aluminum protective cover shall consist of cantilevered bents welded into single structures. Mechanically fastened frame connections can be used if shipping does not allow for welded frames.

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- B. Canopy shall use perimeter false fascia and extruded decking running parallel to length of sidewalk. Beams are to be full welded at both ends to eliminate leaking of water. Extruded Decking shall be a roll-locked design where the extruded cap and pan shall interlock to make a rigid structure. Crimped decking is not allowed. Pans are to be welded at ends to prevent water leakage. Standard T-flashing shall be used where decking is separated at a drain beam. The false fascia is to be secured using a rivet every 4'-0" on center connecting the fascia to the edge pans. Tie back straps are to be installed connecting the top of the fascia to the decking at 4'-0" on center.
- C. Canopies shall drain from the decking into the drain beam and discharge at the bottom of the column.
- D. Deflector plates are to be installed at the bottom of the column to discharge the water away from the column, unless under ground drainage is desired. The deflector plates are to be caulked inside the column and fastened to the column using a single rivet.
- E. Columns are to be locked into the post footer using a single piece of rebar, approximately 9" long, running through the bottom of the column below finished floor.

# 2.3 MATERIALS

- A. Columns
  - 1) Columns are to be radius cornered aluminum tubular extrusion of size required to support structure as determined by manufacturer's engineer of record.. Minimum column size shall be 4"x 4" at 0.188" thick.
  - 2) Provide clear acrylic protection or bituminous paint protection between the aluminum column and the concrete footer.
  - 3) Tombstone shaped water outlet holes are to be cut at the bottom of all draining columns with deflector plates installed inside, unless under ground drainage is desired. Circular drain holes are not allowed.
- B. Beams
  - 1) Beams are to be open topped aluminum tubular extrusion of size required to support structure as determined by manufacturer's engineer of record.
  - 2) Size of beam used shall accommodate applied loadings without over-stress or overdeflection. Minimum beam size shall be 6"x 4" at 0.188" thick.
- C. Decking
  - 1) Decking shall be a rigid roll-locked design that is self flashing and utilizes interlocking sections.
  - 2) Extruded decking is to be of size indicated on architect's drawings.
  - 3) Where decking is run parallel to walkway, the ends of the pans shall be welded closed where decking does not terminate into a drain beam.
- D. False Fascia
  - 1) False Fascia shall be aluminum extrusion of size indicated on architect's drawings. Minimum fascia size shall be 1"x 6" at 0.070" thick.
- E. Flashing
  - 1) Flashing shall be made of aluminum sheet painted to match the color of the canopy. Minimum flashing thickness shall be 0.040" thick.

## 2.4 FASTENERS

A. All fasteners shall be stainless steel with neoprene washers and rivets are 3/16" aluminum.

## 2.5 FINISHES

- A. Factory applied baked enamel
  - 1) Enamel is to comply with AAMA 2603.
  - 2) Color is to be as selected by architect from manufacturer's standard color chart.
  - 3) Custom colors can be used upon the architect's request.

## PART 3 - INSTALLATION AND EXECUTION

## 3.1 ERECTION

- A. Canopies are to be installed according to approved shop drawings and plans.
- B. The entire structure shall be installed straight, true, and plumb according to standard construction procedures.
- C. Canopies shall be installed with positive and negative slope of 1/8" per foot to allow water drainage from top of canopy to draining columns and eliminate ponding.
- D. Non-draining columns shall have weep holes installed at top of concrete to remove condensation from post. Minimum weep hole size shall be 1/4" in diameter.
- E. All joints, corners, and connections shall be tight and clean.
- F. All exposed fasteners are to be painted to match the canopy color.
- G. Decking is to be aligned and secured to aluminum frame structure.

## 3.2 COLUMN FOOTINGS

- A. Styrofoam blockouts shall be provided by the canopy manufacturer and installed by the General Contractor.
- B. General Contractor shall pour the required footer size around the Styrofoam blockouts provided by the manufacturer.

- C. Canopy installer is to remove the Styrofoam after footer has cured, set column in cavity, and fill with minimum 2000 psi grout to level of finished concrete slab.
- D. Slab mounting of aluminum columns for cantilevered canopies is not allowed.
- E. Footer design is not covered in this specification and scope of work. Refer to structural drawings.

### 3.3 CLEANING

- A. All canopy surfaces exposed are to be cleaned after installation is complete.
- B. Surplus materials and debris shall be removed from the jobsite after installation is complete.

## 3.4 PROTECTION

A. General Contractor shall ensure protection of installed aluminum canopies from other construction so that canopies are without damage at time of substantial completion of project.

## SECTION 107300 - ALUMINUM CANOPIES

#### PART 1 GENERAL

- 1.01 SUMMARY
  - A. Section Includes: Design, fabrication, and installation of extruded aluminum wall-hung canopy systems.

#### 1.02 REFERENCES

- A. The Aluminum Association (AA):
  - 1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.
- B. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 2. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- C. American Society of Civil Engineers (ASCE):
  - 1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
- D. American Society for Testing and Materials (ASTM):
  - 1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
  - 2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- E. American Welding Society (AWS):
  - 1. ANSI/AWS D1.2, Structural Welding Code Aluminum.

#### 1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Design in accordance with The Aluminum Design Manual 2000.
  - 2. Comply with the wind requirements of ASCE 7.
  - 3. Provide an all welded extruded aluminum canopy system complete with internal drainage. Non-welded systems are not acceptable.
  - 4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

## 1.04 SUBMITTALS

- A. Product Data: Manufacturer's product information, specifications, and installation instructions for canopy components and accessories.
- B. Shop Drawings: Include plan dimensions, elevations, drainage components, flashings and details.

### C. Samples:

1. Selection: Manufacturer's standard range of colors for the finishes selected.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the canopy system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: At least ten years of experience in the design, fabrication, and erection of extruded aluminum canopy systems.
- B. Installer Qualifications: Have canopy installed by manufacturer, third party installation is not acceptable.
- C. Obtain aluminum canopies from a single manufacturer.

#### 1.06 FIELD MEASUREMENT

- A. Confirm dimensions prior to preparation of shop drawings when possible.
- B. Supply manufacturer's standard literature and specifications for canopies.
- C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

### 1.07 PERFORMANCE REQUIREMENTS

- A. Canopy must conform to local building codes.
- B. PE Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

#### 1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver and store all canopy components in protected areas.

### 1.09 WARRANTY

- A. Manufacturer shall warrant the entire system against defects in labor and materials for a period of one (1) year commencing on the date of substantial completion as established in Division 1 of these specifications.
- B. Intention of this warranty is the manufacturer will come onto the jobsite and do all necessary to effect corrections of any deficiencies.
- C. Prima Facie Evidence of defects in labor and material may include but is not limited to, one or more of the following:
  - a. Moisture Leaks
  - b. Metal failure including excessive deflection
  - c. Fastener failure
  - d. Finish failure

PART 2 PRODUCT

#### 2.01 MANUFACTURERS

- A. The Basis of Design is based on the following systems manufactured by: Mapes Architectural Canopies, 7748 N. 56<sup>th</sup> Street, Lincoln, NE.
  1 "Super Lumideck Elet Soffit Canopy"
  - 1. "Super Lumideck Flat Soffit Canopy".
- B. Comparable products by the following manufacturers, meeting these specifications will also be acceptable:
  - 1. Dittmer Architectural Aluminum.
  - 2. Avadek Walkway Cover Systems.
  - 3. Peachtree Protective Covers, Inc.

#### 2.02 MATERIALS

- A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.
- B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.
- C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.
- D. Gaskets: Dry seal santoprene pressure type.
- E. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

#### 2.04 FABRICATION

- A. General:
  - 1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
  - 2. Welding: In accordance with ANSI/AWS D1.2.
  - 3. Gutter Frame Construction: Factory assemble gutter fascia frames to form a one-piece welded frame. Make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Gutter frames constructed by mechanically fastening components together are not acceptable. Water shall drain from covered surfaces into intermediate trough and be directed to columns or rear downspouts.
  - 4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each.
- B. Beams: Where applicable provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.
- C. Support columns and gutter beams shall be designed such that the columns will be notched to create a "saddle" that will receive and secure the gutter beams.
- D. Decking shall be designed with interlocking self-flashing extruded aluminum members with mechanical fasteners field applied to provide structural integrity for the completed assembly.

- E. Gutter Fascia: Where applicable provide "j-shaped" gutter fascia capable in manufacturer's standard sizes.
- F. Fascia: Where applicable provide manufacturer's standard fascia in standard sizes.
- G. Hanger Assemblies: Provide extruded aluminum hanger rods in manufacturer's standard shapes and sized to meet the loads seen by canopy. Provide sleeves and spaces as required so forces of canopy are on CMU or structure behind brick veneer / metal panels.
- H. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to column or downspout drain.
- I. Protect columns embedded in concrete from electrolytic reaction.
- L. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.
  - 1. High performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
    - a. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
    - b. Color and Gloss: As selected by Architect from manufacturer's full line of standard colors.

### PART 3 EXECUTION

#### 3.01 COORDINATION

A. Coordinate location and requirements of blocking, wall supports, footings, etc.

#### 3.02 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

#### 3.03 ERECTION GENERAL

- A. Erect canopies true to line, level, and plumb.
- B. Provide hairline miters and fitted joints.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.
- D. Installation shall be in strict accordance with manufacturer's shop drawings and published installation instructions. Particular attention should be given to protecting the finish during handling and erection.

#### 3.05 CLEANING

A. Clean all canopy components promptly after installation.

# 3.06 PROTECTION

A. Protect materials during and after installation.

END OF SECTION 107300

SECTION 107516 – GROUND-SET FLAGPOLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes ground-mounted flagpoles made from aluminum.
- B. Owner-Furnished Material: Flags.

### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- C. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.
- D. Warranty.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.
- 1.4 DELIVERY, STORAGE, AND HANDLING
  - A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

### 1.5 WARRANTY

- A. Pole: Lifetime manufacturer's warranty.
- B. Hardware: One-year manufacturer's warranty.

### PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Flagpole; a Kearney-National Inc. company.
  - 2. Atlantic Fiberglass Products, Inc.
  - 3. Baartol Company.
  - 4. Concord Industries, Inc.
  - 5. Eder Flag Manufacturing Company, Inc.
  - 6. Ewing Flagpoles.
  - 7. Lingo Inc.; Acme Flagpole Company Division.
  - 8. Millerbernd Manufacturing Company.
  - 9. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
  - 10. PLP Composite Technologies, Inc.
  - 11. Pole-Tech Company Inc.
  - 12. U.S. Flag & Flagpole Supply, LP.
  - 13. USS Manufacturing Inc.

### 2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
  - 3. Provide self-aligning, snug-fitting joints.
- B. Exposed Height: 30 feet
- C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- (1.6-mm-) nominal wall thickness. Provide with 3/16-inch (4.8-mm) steel bottom plate and support plate; 3/4-inch- (19-mm-) diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
  - 1. Provide flashing collar of same material and finish as flagpole.

### 2.3 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
  - 1. 0.063-inch (1.6-mm) spun aluminum with gold anodic finish.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
  - 1. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.
    - a. Provide with neoprene or vinyl covers.

## 2.4 MISCELLANEOUS MATERIALS

- A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- B. Sand: ASTM C 33, fine aggregate.
- C. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Division 07 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

#### 2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

#### 2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

- D. Place concrete, as specified in Division 03 Section "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

## 3.3 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure. Install flagpole, plumb, in foundation tube.
  - 1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch (50-mm) layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 107516

# SECTION 114000 - FOODSERVICE EQUIPMENT

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fabricated equipment.
  - 2. Food waste machines.
  - 3. Cooking equipment.
  - 4. Self-contained refrigeration equipment.
  - 5. Hot food cabinet equipment
  - 6. Walk-in refrigeration equipment.
  - 7. Powered food-preparation equipment.
  - 8. Ware washing equipment.
  - 9. Kitchen exhaust hoods and rooftop equipment
  - 10. Utility distribution systems.
- B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.
- C. Work under this section includes coordination of the kitchen and servery equipment installation. Responsibilities include and are not limited to construction coordination, utility rough-in spot location, schedule coordination and installation coordination with the proper trades. Equipment shall be leveled and installed in a manner consistent with manufacturers specifications and recommendations, initial start-up, balance and staff training shall be completed by the FSES. Work shall also include receiving, delivering, uncrating, assembly and installation of the equipment contained herein and make ready for final connections to the building utilities by other contractors.

### 1.3 COORDINATION

- A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures electrical equipment, HVAC equipment, fire-suppression system components and utility distribution system.
- B. Work under this contract is responsible for identifying and resolving potential conflicts with this section and the proper execution of this foodservice section 114000 as it is coordinated with the general construction of the affected areas and rough-ins provided under separate contracts.
- C. Coordinate locations and requirements of utility service connections.
- D. Coordinate sizes, locations, and requirements of the following:

- 1. In-wall/floor slab plumbing
- 2. In-wall/floor slab electrical
- 3. In wall/floor slab mechanical
- 4. Overhead equipment supports.
- 5. Equipment bases.
- 6. Floor depressions for floor troughs.
- 7. Walk-in cooler/freezer
- 8. Insulated floors.
- 9. Floor areas with positive slopes to drains.
- 10. Floor sinks and drains serving foodservice equipment.
- 11. Roof curbs, equipment supports, and penetrations.

### 1.4 PROJECT MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site
- B. Progress Meetings: Attend all progress meetings to facilitate pre-installation coordination of bid documents, submittal drawings, and equipment brochure information with the owners designated representative, Architect, GC, and proper trades.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include the following:
  - 1. Manufacturer's model number.
  - 2. Accessories and components that will be included for Project.
  - 3. Clearance requirements for code, access and maintenance.
  - 4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions, special conditions or site requirements.
- B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, materials, metal gauge, utility service requirements, and attachments to or impacts on other work.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.

# 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For foodservice facilities.
  - 1. Indicate locations of foodservice equipment and connections to utilities.
  - 2. Key equipment using same designations as indicated on Drawings.
  - 3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
  - 4. Include details of seismic bracing for equipment.
- B. Sample Warranty: For special warranty.

## 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Product Schedule: For each foodservice equipment item, include the following:
      - 1) Designation indicated on Drawings.
      - 2) Manufacturer's name and model number.
      - 3) List of factory-authorized service agencies including addresses and telephone numbers.

#### 1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

#### 1.9 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within 5 years of installation and start up. Failure includes but not limited to refrigeration equipment(s) failure to hold set temperature(s). All FSES Equipment to be provided with manufacturer warranty for 2 years minimum parts and labor. Refrigeration and Hot Food Cabinets 3 years, Refrigeration compressors shall carry 5 year replacement parts and labor warranty.

## PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.
- B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
- C. Steam Equipment: Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with 2013 ASME Boiler and Pressure Vessel Code.
- D. Regulatory Requirements: Install equipment to comply with the following:
  - 1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
  - 2. NFPA 54, "National Fuel Gas Code."
  - 3. NFPA 70, "National Electrical Code."

- 4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."
- E. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

### 2.2 FOOD SERVICE EQUIPMENT

A. Refer to drawings for scheduled equipment, products and additional requirements.

#### 2.3 MISCELLANEOUS MATERIALS

- A. Installation Accessories, General: NSF certified for end-use application indicated.
- B. Elastomeric Joint Sealant: ASTM C 920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
  - 1. Public Health and Safety Requirements:
    - a. Sealant is certified for compliance with NSF standards for end-use application indicated.
    - b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.
  - 2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

### 2.4 FINISHES

- A. Stainless-Steel Finishes:
  - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
  - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
    - a. Run grain of directional finishes with long dimension of each piece.
    - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

- 1. Connect equipment to utilities.
  - a. All final connections to building utilities are to be provided by the proper trades.
  - b. EC to provide disconnects and wiring from owner provided breaker panel to disconnects and electrical building wall, floor, or electrical drops down from above Food Service equipment
  - c. EC, MC, to provide single point connections to RTU tempered MUA units for exhaust hood, Utility distribution systems, work island load centers and plumbing fixtures
  - d. GC to provide all wall, floor, roof, penetrations and associated fire proofing of those areas if applicable
- 2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
- 3. Food Service Equipment supplier will install kitchen exhaust hood, condensate hood, walk-in cooler freezer unit
- B. Complete equipment assembly where field assembly is required.
  - 1. Provide closed butt and contact joints that do not require a filler.
  - 2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.
- C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
- D. Install cabinets and similar equipment on bases in a bed of sealant.
- E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.
- F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

### 3.2 CLEANING AND PROTECTING

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

### 3.3 DEMONSTRATION

A. Train owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

#### SCHEDULE OF EQUIPMENT

### ITEM 1 - EXHAUST HOOD WITH MAKE UP AIR UNIT (1 REQ'D)

Avtec Model CUSTOM Custom Exhaust Hood with MUA, Duct, Curbs Fans, Controls Canopy Food Service Equipment Supplier to Furnish and Install Lights, Controls, Sensors See Shop Drawings

Acceptable Manufacturers: AVTEC, Select Air, Master Air

ITEM 1A - EXHAUST FAN (1 REQ'D)

Avtec Model CUSTOM Custom Exhaust Hood with MUA Food Service Equipment Supplier to Furnish and Install See Shop Drawings

Acceptable Manufacturers: AVTEC, Select Air, Master Air

ITEM 1B - EXHAUST MAKE UP AIR UNIT (1 REQ'D)

Avtec Model CUSTOM Custom Exhaust Hood with MUA Food Service Equipment Supplier to Furnish and Install See Shop Drawings

Acceptable Manufacturers: AVTEC, Select Air, Master Air

ITEM 1C - EXHAUST MAKE UP AIR UNIT (1 REQ'D)

Avtec Model CUSTOM Custom Exhaust Hood with MUA Food Service Equipment Supplier to Furnish and Install See Shop Drawings

Acceptable Manufacturers: AVTEC, Select Air, Master Air

#### ITEM 2 - CONDENSATE EXHAUST HOOD (1 REQ'D)

Avtec Model CUSTOM Custom Condensate Exhaust Canopy Type For C44 Dishwasher Hood Food Service Equipment Supplier to Furnish and Install See Shop Drawings Jefferson Elementary School Henderson County Schools Henderson, Kentucky

Acceptable Manufacturers: AVTEC, Select Air, Master Air

## ITEM 2A - CONDENSATE EXHAUST FAN (1 REQ'D)

Avtec Model CUSTOM Custom Condensate Exhaust Fan For Canopy Type For C44 Dishwasher Food Service Equipment Supplier to Furnish and Install See Shop Drawings 120v/60/1phase

Acceptable Manufacturers: AVTEC, Select Air, Master Air

## ITEM 3 - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Custom Model CUSTOM Walk in Cooler Freezer Combination Unit Food Service Equipment Supplier to Furnish and Install Lights, Heat Trace, and Controls See Shop Drawings

Acceptable Manufacturers: Louisville Cooler, American Panel, Kolpack

### ITEM 3A - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Custom Model CUSTOM Walk in Cooler Evaporator

Acceptable Manufacturers: Louisville Cooler, American Panel, Kolpack

ITEM 3B - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Custom Model CUSTOM Walk in Cooler Compressor

Acceptable Manufacturers: Louisville Cooler, American Panel, Kolpack

ITEM 3C - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Custom Model CUSTOM Walk in Freezer Evaporator

Acceptable Manufacturers: Louisville Cooler, American Panel, Kolpack

ITEM 3D - WALK IN COMBINATION COOLER FREEZER, REMOTE (1 REQ'D)

Custom Model CUSTOM

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

Walk in Freezer Compressor

Acceptable Manufacturers: Louisville Cooler, American Panel, Kolpack

ITEM 4 - CUSTOM (1 REQ'D) Avtec Model CUSTOM

Utility Header - Electric, Water - Final Connections Proper Trades 480/3 phase, 208/3 phase, 208/1phase, 120/phase Hot and Cold Water

Acceptable Manufacturers: AVTEC, Select Air, Master Air

ITEM 5 - COMBI OVEN, ELECTRIC (2 REQ'D)

RATIONAL Model B628106.43 Dimensions: 29.75(h) x 42(w) x 38.25(d)

(SCC 62 E 480V) SelfCooking Center® Combi Oven/Steamer, electric, (6) 18" x 26" full size sheet or (12) 12" x 20" full size hotel pan capacity, iCookingControl with 7 modes, HiDensityControl®, iLevelControl, Efficient CareControl, Combi-Steamer with 3 modes, core temp probe with 6 point measurement, hand shower with automatic retracting system, (3) grid shelves, ethernet interface, 480v/60/3-ph, 31.5 amps, 22.1 kW (dual voltage: retrofitable to 440v/60/3-ph, 29.0 amps, 22.1 kW), cULus, NSF, ENERGY STAR® (KNLZ listed by UL & City-wide COA by FDNY for New York City in single and stacked combination with an UltraVent Plus)

- 2 ea NOTE: All discounts subject to approval by manufacturer
- 2 ea 2 years parts and labor, 5 years steam generator warranty
- 2 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge
- 1 ea 
  Optional> Model 9999.9951 RCI Rational Certified Installation, new certified installation cost for a countertop model is \$1000 for the first unit (61/62/101/102) (Pricing based on a 50 mile radius, Additional charges may apply, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 1 ea 
  Optional> Model 9999.9957 RCI Rational Certified Installation, additional countertop unit installed at same location on same day will be an additional \$800 per countertop unit (61/62/101/102) (Pricing based on a 50 mile radius, Additional charges may apply, See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 2 ea Coptional> Model 8720.1552US Installation Kit, for electric SCC WE/CMP 61 (208/60/3 & 240/60/3); electric SCC WE/CMP 101 (440/60/3 & 480/60/3); electric SCC WE/CMP 62 (440/60/3 & 480/60/3) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
- 1 ea Model 1900.1150US Water Filtration Double Cartridge System, for Combi-Duo models 62/62 or 62/102 or if used for more than 2 units includes: (1) double head with pressure gauge, (2) R95H filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges)
- 1 ea
   < Optional> Model 9999.8448 RCI Rational Certified Installation, additional installation cost for a Rational Water Filter System is available when purchased with Certified Installation of Rational unit (Pricing based on a 50 mile radius, additional charges may apply. See attached flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET)
   1 ea
   NOTE: The Rational Water Filtration Systems helps provide consistent high quality water to your RATIONAL SelfCooking Center or your CombiMaster Plus. The patented carbon

	block technology reduces the effects of sediment, chloramines and chlorine while provid-
1 ea	NOTE: All public water systems using surface water and most ground water systems
i du	treat with either chlorine/chloramine or chlorine dioxide (EPA will allow levels as high as
	4ppm safe for drinking water, exceeding our maximum level of .2ppm.
1 ea	NOTE: Chloride concentrations above 80ppm can cause corrision. RATIONAL Water
	Filtration does NOT reduce chloride
1 ea	Free Water Testing Kits are available (contact factory for info)
2 ea	Model 56.00.210A Cleaner tablet without Phosphorus, for ALL SelfCookingCenter® units
	since 2004 & CombiMaster® Plus units with article #BXXXXXX or Serial MI series since
	4/2017, goes up to 70% further than liquid cleaner, "FREIGHT CLASS 85 LIMITED
_	QUANTITY" (minimum order quantity: 2pcs, unless ordered with a unit)
2 ea	Model 56.00.562 Care Tablets, bucket of 150 packets for all SelfCooking Center® units
	from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity:
1	Zpcs, unless ordered with a unit) Medel 60 74 060 Cambi Due Stacking kit, bettem unit 62 er 102 electric, enen kit, etc.
Tea	tionary ton unit 62 electric or gas
1 ea	Model 60.30.365 LIG L Stationary Low Oven Stand, all sides open, height 8-1/4" to be
i ca	used with a combi-duo stacking kit with feet stainless steel construction for Combi-Duo
	type SCC 62/CMP 62
1 ea	<pre></pre> <pre></pre> <pre></pre>
	tion cost for a Combi-Duo stacked unit is \$200 for the first two units for double-stack
	(Pricing based on a 50 mile radius, Additional charges may apply, See attached installa-
	tion flyer for details) THIS ITEM IS NON-DISCOUNTABLE. USA ONLY (NET)
6 ea	<optional> Model 6010.2101 Gastronorm Grid Shelf, 2/1 size, 25-5/8" x 20-7/8", stain-</optional>
	less steel
2 ea	Model 60.70.776 Grease Drip Container, 2/1 GN, 25-5/8" x 20-7/8" x 1-1/2" deep for type
10	SCC 62/CMP 62, SCC 102/CMP 102 and SCC/CMP 202 units (special order item)
12 ea	Model 6019.1150 Complery Basket, 1/1 GN, 12-3/4" X 20-7/8" (SCHOOL PROMO, NO
	CHARGE) NOTE: VEDIEVIE INSTALLATION, SITE SUDVEV, INSTALLATION KIT, OD
	ADDITIONAL CRID SHELVES ***ALL OHOTED AS OPTIONAL *** ARE REQUIRED
	NOTE: RATIONAL LINIT IS NOT AVAILABLE WITH CHEMICAL STORAGE
	CONTAINER AS SPECIFIED. VERIEV IF ACCEPTABLE
	NOTE: OPTIPURE FILTRATION IS BY OTHERS, RATIONAL FILTRATION IS QUOTED
	VERIFY IF ACCEPTABLE

#### ITEM RCI NOTE - RCI RATIONAL Model RCI

RATIONAL CERTIFIED INSTALLATION INCLUDES:

1. Travel within 50 miles (100 miles RT) of installer

RATIONAL will provide a list of Certified Service Agents upon request, should you need to establish whether or not there will be additional mileage/travel charges (over 50 miles each way) when purchasing Certified Installation.

\*DEALER TO Call closest Service Agent to determine, what/if additional mileage charges will be

- 2. Professionally reviewed and managed install process
- 3. Assembly of purchased equipment
- 4. Stacking of purchased equipment
- 5. Placement of the unit
- 6. Leveling of the unit
- 7. Connection of utilities within 3-5 feet of unit

8. Operational functional test

\*Installation of units outside of a major metropolitan area may require an additional travel charge payable by the end-customer. It is the dealers responsibility to advise the customer, should there be additional charges. Contact Rational Technical Department to inquire mileage between service partner and end-customer.

\*You may contact the Authorized Service Agent to provide a quote needed for additional mileage charges, when travel

exceeds 50 miles one way.

#### RATIONAL CERTIFIED INSTALLATION DOES NOT INCLUDE:

1. Delivery to end user location: unit to be within 5 ft of final destination with a clear, unobstructed path

- 2. Pre-Installation site survey conducted prior to shipment of equipment order
- 3. Special licensing or permits
- 4. Overtime travel or labor
- 5. Removal of packing materials and old equipment
- 6. Installation kit

Acceptable Manufacturers: RATIONAL, CONVOTHERM, ELOMA

# ITEM 6 - CONVECTION OVEN, GAS (1 REQ'D)

Vulcan Model VC44GC Dimensions: 70(h) x 40(w) x 42.25(d)

Convection Oven, gas, double-deck, standard depth, computer controls, electronic spark igniters, 99-hour timer, (5) nickel plated racks per oven, 8" high legs, stainless steel front, top and sides, stainless steel doors with windows, 50,000 BTU each section, NSF, CSA Star, CSA Flame, ENERGY STAR®

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea Natural gas (add -1 suffix) (specify elevation if over 2,000 ft.)
- 1 ea (2) 120v/60/1-ph, 15.4 amps total, (2) 6' cords with plugs, standard
- 1 ea Gas manifold piping included with stacking kit to provide single point gas connection

Acceptable Manufacturers: VULCAN, GARLAND, MONTAGUE

ITEM 7 - RANGE, 36", 6 OPEN BURNERS (1 REQ'D)

Vulcan Model 36S-6BN Dimensions: 58(h) x 36(w) x 34(d)

Endurance<sup>™</sup> Restaurant Range, natural gas, 36", (6) 30,000 BTU burners, lift-off burner heads, standard oven, stainless steel front, sides, backriser, & lift-off high shelf, fully MIG welded chassis, 6" adjustable legs, 215,000 BTU, CSA, NSF

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea K-12 School Nutrition extended warranty extends the warranty for 12 months beyond the 12 month Original Equipment Warranty, not to exceed 24 months from date of installation
- 1 ea Stainless steel backriser and lift-off high shelf, standard
- 1 ea Model CASTERS ADJRR4 Adjustable casters, 6", set of 4 (2 with locks)

Acceptable Manufacturers: VULCAN, GARLAND, MONTAGUE

ITEM 8 - TILTING SKILLET BRAISING PAN, GAS (1 REQ'D)

Vulcan Model VG30 Dimensions: 40.5(h) x 36(w) x 35.5(d)

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

Braising Pan, Gas, 30-gallon capacity, 36" wide open base, manual tilt, 9" deep stainless steel pan with gallon markings, pouring lip & removable strainer, spring assist cover with drip edge, pan holder, solid state control, includes L faucet bracket, electric ignition, 12" stainless steel legs with adjustable flanged feet, 90,000 BTU, CSA Flame, CSA Star, UL EPH Classified

- 1 ea 1 year limited parts & labor warranty, standard
- 1 ea Natural gas (add -1 suffix) (specify elevation if over 2,000 ft.)
- 1 ea NOTE: Elevation kits are field installed
- 1 ea 120v/60/1-ph, 9.0 amps, cord & plug, standard
- 1 ea Model DBFCTTS WSHDWN DOUBLE Pantry Deck Mount Faucet, with backflow preventer, washdown hose, wall hook, NSF and Lead Reduction Compliant
- 1 st Model CASTERS BP Set of 4 adjustable casters 2 locking

Acceptable Manufacturers: VULCAN, GROEN, CLEVELAND

# ITEM 8A - FLOOR TROUGH (1 REQ'D)

Advance Tabco Model FTG-2436 Dimensions: 4(h) x 36(w) x 24(d) Floor Trough, 36"W x 24"D x 4" deep, 14 gauge 304 stainless steel, includes stainless steel subway grating constructed from 3/16" x 1" bars, removable stainless steel strainer basket, 4" O.D. waste pipe 3"L, pitched towards waste

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 9 - FLOOR TROUGH (2 REQ'D)

Advance Tabco Model FTG-1224 Dimensions: 4(h) x 24(w) x 12(d) Floor Trough, 24"W x 12"D x 4" deep, 14 gauge 304 stainless steel, includes stainless steel subway grating constructed from 3/16" x 1" bars, removable stainless steel strainer basket, 4" O.D. waste pipe 3"L, pitched towards waste

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 10 - SPARE NO. <Spare No.>

### ITEM 11 - PASS-THRU REFRIGERATOR (1 REQ'D)

Traulsen Model AHT232WPUT-HHS Dimensions: 83.25(h) x 58(w) x 37.94(d) Spec-Line Refrigerator, Pass-thru, two-section, self-contained refrigeration, stainless steel exterior, aluminum interior, standard depth, wide half-height door or doors with Santoprene® EZ-Clean Gaskets, (3) adjustable wire shelves per section, INTELA-TRAUL<sup>™</sup> microprocessor controls, 6" adjustable stainless steel legs, 5/8 HP, cULus, NSF

- 1 ea 115v/60/1ph, 8.6 amps, with cord & NEMA 5-15P, standard
- 1 ea 3 year service/labor, 5 year compressor warranty, standard
- 1 ea Thermometer side: Left door hinged left/right hinged right, standard
- 1 ea Rear: Left door hinged left/right hinged right, standard
- 2 ea #4 Tray slide for (1) 18"x26" pan per pair, 1/2 section
- 4 ea Half height glass door in lieu of solid, per door
- 1 st Casters, 6" high (set of 4)

Acceptable Manufacturers: TRAULSEN, DELFIELD, CONTINENTAL

# ITEM 12 - PASS-THRU HEATED CABINET (2 REQ'D)

Traulsen Model AHF132WP-HHS Dimensions: 83.38(h) x 29.88(w) x 37.94(d)

Spec-Line Heated Cabinet, Pass-thru, one-section, stainless steel exterior, aluminum interior, standard depth cabinet, half-height door or doors with Santoprene® EZ-Clean Gaskets, (3) chrome plated adjustable shelves per section, INTELA-TRAUL<sup>™</sup> microprocessor controls, 6" adjustable stainless steel legs, NSF, UL

- 2 ea 208/115v/60/1ph, 7.8 amps, standard
- 2 ea 3 year service/labor warranty, standard
- 2 ea Thermometer side door: hinged on right, standard
- 2 ea Rear door hinged on left, Front Door Hinged Left
- 2 ea #4 Tray slide for (1) 18"x26" pan per pair, 1/2 section
- 4 ea Half height glass door in lieu of solid, per door

Acceptable Manufacturers: TRAULSEN, DELFIELD, CONTINENTAL

### ITEM 14 - MEAT SLICER (1 REQ'D)

Hobart Model EDGE13A-11 Dimensions: 28.15(h) x 27.58(w) x 22.83(d)

Slicer, automatic, single speed, single stroke length, med duty, angle feed, 13" chrome plated carbon steel knife, carriage & gauge interlocks, no volt release, poly-v belt drive system, anodized aluminum carriage & knife cover, top mounted sharpener, product fence, anodized aluminum finish, 120v/60/1-ph, 4.0 amp, 1/2 hp, cETLus, NSF

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

Acceptable Manufacturers: HOBART, BERKEL, GLOBE

ITEM 15 - SPARE NO. <Spare No.>

ITEM 16 - DISHWASHER, CONVEYOR TYPE (1 REQ'D)

Hobart Model CL44EN-BAS+BUILDUP Dimensions: 68.5(h) x 44.75(w) x 31.25(d)

Conveyor Dishwasher, single tank, (202) racks/hour, With Water Softener WS-40 insulated hinged doors, .62 gallon/rack, stainless steel enclosure panels, microprocessor controls with low temperature & dirty water indicators, NSF pot & pan mode, ENERGY STAR®, Free factory startup for installations within a 50 mile radius of a Hobart service office; installation beyond 50 miles will be charged at the quoted rate by the local Hobart service office

1 ea Standard warranty - 1-Year parts, labor & travel time during normal working hours within the USA

- 1 ea Model CL44EN-BASELE0CD 480v/60/3-ph
- 1 ea Model CL44EN-BASHTE15K Electric tank heat 15kW
- 1 ea Model CL44EN-BASERH30K 30kW electric booster
- 1 ea Model CL44EN-BASDIR0RL Right to left operation
- 1 ea Model CL44EN-BASHGTSTD Standard height
- 1 ea Model CL44EN-BASFETSTD Standard feet

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- 1 ea Model WS40-NOINSTALL Water Softening System, 2,527 grains/lb capacity, 5 gallons regeneration volume, & salt alarm, holds 1 bag of salt, pricing DOES NOT include standard installation. INSTALLATION BY AUTHORIZED HOBART SERVICE OFFICE IS RECOMMENDED, for steam equipment, a CB15K-SYSTEM or CB30K-SYSTEM is required for treatment of Chlorine & Chloramines (NET)
- 1 ea Model DTV-CLEN Drain water tempering kit for CLEN models
- 1 ea Installation of DWT kit only (NET)
- 1 ea Model CLE/TBL-SWITCH Table LMT switch CLE-Series

Acceptable Manufacturers: HOBART, CHAMPION, MEIKO

ITEM 16A - PAN DISHWASHER RACK (4 REQ'D)

Vollrath Model TR23 Dimensions: 19.75(w) x 19.75(d)

Rack-Master<sup>™</sup> Dishwasher Sheet Pan Rack, full size, open end, 19-3/4"W x 19-3/4"D, 2-1/4" space between dividers, accommodates (3) full size bun pans at angle, designed to fit standard height conveyor dish machines, co-polymer plastic with chrome plated wire insert, NSF, Made in USA

Acceptable Manufacturers: VOLLRATH, CARLISLE, OR EQUAL

## ITEM 16B - PAN DISHWASHER RACK (4 REQ'D)

Vollrath Model TR22 Dimensions: 19.75(w) x 19.75(d)

Rack-Master<sup>™</sup> Dishwasher Tray Rack, full size, open end, 19-3/4"W x 19-3/4"D x 5-1/4"H, for insulated trays & steam table pans, co-polymer plastic with chrome plated wire insert, NSF, Made in USA

Acceptable Manufacturers: VOLLRATH, CARLISLE, OR EQUAL

ITEM 16C - FLATWARE DISHWASHER RACK (4 REQ'D)

Vollrath Model 1397 Dimensions: 5.25(h) x 24.38(w) x 24.5(d) Traex® Flatware Soak & Washing Systems, open rack (19-3/4"W x 19-3/4"D) & full tub (24-1/2"W x 24-3/8"D x 5-1/4"H), co-polymer plastic, beige

Acceptable Manufacturers: VOLLRATH, CARLISLE, OR EQUAL

ITEM 16D - DISHWASHER RACK, PEG / COMBINATION (8 REQ'D)

Vollrath Model TR14 Dimensions: 4(h) x 19.75(w) x 19.75(d) Rack-Master® Dishwasher Stock Rack, plate & tray rack, open bottom & sidewalls, full size, 3-1/4" inside height, handles on all (4) sides, beige co-polymer plastic, double wall construction, snap-fit extenders/construction, beige, rack cannot be personalized, NSF, Made in USA

Acceptable Manufacturers: VOLLRATH, CARLISLE, OR EQUAL

ITEM 17 - THREE (3) COMPARTMENT SINK (1 REQ'D)

Advance Tabco Model FS-3-2424-24RL Dimensions: 43(h) x 120(w) x 29.5(d) Fabricated NSF Sink, 3-compartment, 24" right & left drainboards, bowl size 24" x 24" x 14" deep, 14 gauge 304 stainless steel, tile edge splash, rolled edge, faucet holes on 8" centers, stainless steel legs, 1" Jefferson Elementary School Henderson County Schools Henderson, Kentucky

adjustable stainless steel bullet feet, NSF, overall 29-1/2" F/B x 120" L/R (requires 2 faucets)

2 ea Model K-476 Punch hole for overflow drain, (1) punch required for each overflow drain, (please specify make & model of overflow used) (required for overflows unless using K-15)

- 1 ea Model K-460A Installation, disposal cone with 14" x 16" control bracket & faucet holes (each)
- 1 ea Model K-37 Anti-Siphon vacuum breaker holes

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 17A - PRE-RINSE FAUCET ASSEMBLY, WITH ADD ON FAUCET (1 REQ'D)

T&S Brass Model B-0133-01

EasyInstall Pre-Rinse Unit, mixing faucet, 8" wall mount, 14" add-on 063X swing nozzle, 18" riser, overhead spring, lever handles, 56" flex hose, Eterna cartridges, spray valve (B-0107), 9" wall support (B-0109-02), 1/2" male NPT, EPAct2005 Compliant Punch Basins for Over flow T&S B-3950-01

Acceptable Manufacturers: T&S BRASS, FISHER, OR EQUAL

ITEM 17B - DRAIN, LEVER / TWIST WASTE (3 REQ'D)

T&S Brass Model B-3950-01

Waste Valve, twist handle, 3-1/2" sink opening, 2" drain outlet with 1-1/2" adapter & overflow assembly (replaces B-3916-01)

Acceptable Manufacturers: T&S BRASS, FISHER, OR EQUAL

ITEM 18 - WALL CABINET (2 REQ'D)

Advance Tabco Model WCS-15-60 Dimensions: 32.5(h) x 60(w) x 15(d) Cabinet, wall mount, enclosed design with (2) sliding doors, 60"W x 15"D, with single intermediate shelf, 18/430 stainless steel construction, NSF

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 19 - SPARE NO. <Spare No.>

ITEM 20 - SPARE NO. <Spare No.>

ITEM 21 - DISHTABLE, SOILED "L" SHAPED (1 REQ'D)

Advance Tabco Model DTS-G70-120R Dimensions: 44(h) Island-Soil Dishtable, L-shaped, right-to-left, 10-1/2"H backsplash one side, with pre-rinse sink, stainless steel legs, with crossrails, 119" long, 16/304 stainless steel, with pass thru and undershelf. PROVIDE INTEGRAL PASS THRU WITH SOILED DISH TABLE AS SHOWN ON DRAWINGS.

1 ea SPECIFY DISH MACHINE BRAND & MODEL to ensure proper fit, refer to attached document

(AQ only) or consult www.advancetabco.com for compatibility listing. Certain dish machines require modifications at additional cost not shown here

- 4 ft Model DTA-84 Simple Pass-Thru (sold per linear foot) (minimum 3 ft)
- 1 ea Print required
- 1 ea Specify wall thickness
- 1 ea Specify wall height
- 1 ea Specify distance from dish machine

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

# ITEM 21A - WASTE COLLECTOR (1 REQ'D)

InSinkErator Model PRP Dimensions: 48(h) x 29.5(w) x 39(d)

PowerRinse® Pot/Pan (Model PRP<sup>™</sup>) - Complete Waste Collection System Package. Requires only 1 GPM (3.79 LPM) of fresh water per hour. Pre-rinse and scrapping system with 30 GPM (113.56 LPM) recirculated water flow capability, dry start protection, and adjustable run time. Pre-plumbed and prewired base assembly with control, solenoid and pump; integrated air gap; stainless steel mounting tray, base assembly, cover, pump housing, 1/4" pump inlet screen, and pump impeller; 1/4" perforated scrap basket with four ergonomic handles; flanged feet; check valves; 2" drain discharge; 1/2" NPT water inlets.

- 1 ea Model PRP-4 460-480v/60/3-ph
- 1 ea Model PR-SCRAP BASKET Additional scrap basket, high impact polymer with1/4" (6.35 mm) screen, (4) ergonomic handles, for any PowerRinse model (15427A)
- 1 ea Model COVER Cover, stainless steel, maximizes workspace for scrapping and presoaking problem dishes with baked-on or difficult to remove food (15426)

Acceptable Manufacturers: INSINKERATOR, SALVAJOR, HOBART

# ITEM 21B - PRE-RINSE FAUCET ASSEMBLY, WITH ADD ON FAUCET (1 REQ'D)

### T&S Brass Model B-0133-01

EasyInstall Pre-Rinse Unit, mixing faucet, 8" wall mount, add-on 063X swing nozzle, 18" riser, overhead spring, lever handles, 56" flex hose, eterna cartridges, spray valve, 9" wall support, 1/2" male NPT, EPAct2005 Compliant, (B-0109-02/B-0107)

Acceptable Manufacturers: T&S BRASS, FISHER, OR EQUAL

# ITEM 22 - DISHTABLE, CLEAN "L" SHAPED (1 REQ'D)

Advance Tabco Model DTC-K30-96L Dimensions: 44(h)

Korner Clean Dishtable, L-shaped, right-to-left, 10-1/2" backsplash, 3" rolled front & side rims, stainless steel legs, with stainless steel crossrails, 95" long, 14 gauge 304 stainless steel

1 ea SPECIFY DISH MACHINE BRAND & MODEL to ensure proper fit, refer to attached document (AQ only) or consult www.advancetabco.com for compatibility listing. Certain dish machines require modifications at additional cost not shown here

- 1 ea Model DTA-75 Provision for limit switch (limit switch by others)
- 1 ea Model DTA-SS-90 Dishtable Undershelf, 90"W x 24"D, adjustable die cast leg clamps, stainless steel (size undershelf to be at least 6" shorter than dishtable)
- 1 ft Model TA-94A 14 gauge 304 stainless steel undershelf upgrade (per linear foot) (also requires TA-23 welded set up for tables normally supplied 'knocked down')
- 1 ea Model TA-23 Welded Set Up Table/Shell Crating (per table)

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 23 - ICE CUBER WITH BIN (1 REQ'D)

Manitowoc Model UD-0240A Dimensions: 38.5(h) x 26(w) x 28(d)

NEO<sup>™</sup> Undercounter Ice Maker, cube-style, air-cooled, self contained, 26"W x 28"D x 38-1/2"H, up to 225-lb. approximately/24hrs, 80 lbs ice storage capacity, electronic controls, dice size cubes, NSF, cETLus, CE, ENERGY STAR®

- 1 ea 3 year parts & labor Commercial warranty
- 1 ea 5 year parts & labor Commercial warranty on evaporator
- 1 ea 5- year parts & 3 year labor Commercial warranty on compressor
- 1 ea (-161) 115v/60/1-ph, 7.0 amps, 6 ft cord with NEMA 5-15P
- 1 ea Model K-00452 LuminIce II Growth Inhibitor Kit for U Series (NEO®) Undercounters
- 1 ea Model AR-PRE Arctic Pure® Pre-Filter Assembly, 5 micron filtration includes head, shroud, hardware, mounting assembly, & (1) filter cartridge, (NOT stand-alone; should be used in conjunction with primary water filter assembly)

Acceptable Manufacturers: MANITOWOC, ICE O MATIC, HOSHIZAKE

ITEM 24 - BY VENDOR (2 REQ'D)

Beverage Air Model SMF49Y-1-S Dimensions: 47.13(h) x 49(w) x 33.5(d)

EXISTING BY VENDOR NOT IN CONTRACT

School Milk Cooler, forced air, 49" W, 33-1/2" D, 17.28 cu. ft., single access, exterior digital thermometer, (12) 13" x 13" x 11" or (8) 19" x 13" x 11" case capacity, stainless steel interior and exterior, 7" heavy duty

- casters, (2) with brakes, 1/5 hp, UL, cULus, UL EPH, NSF, MADE IN USA
- 2 ea 3 years parts & labor warranty (excludes maintenance items)
- 2 ea Additional 2 yr compressor warranty, standard
- 2 ea 115v/60/1-ph, 4.2 amps, standard
- 2 ea 7" Heavy duty casters, (2) with brakes, standard

## ITEM 25 - FLATWARE & TRAY CART (2 REQ'D)

Randell Model RAN SW-8 Dimensions: 35(h) x 30(w) x 30(d)

RanServe Tray & Silverware Dispenser, 30"W x 30"D x 35"H, enclosed mobile design, eight-hole silverware holder, stainless steel shelf area for tray stacking, 16 gauge stainless steel top with plastic laminate panels, swivel casters (2 locking)

2 ea Model RSEXTSS-SW8 Stainless steel exterior for 30" silverware stands

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

ITEM 26 - CASH REGISTER STAND (1 REQ'D)

Randell Model RAN CA Dimensions: 35(h) x 30(w) x 30(d)

RanServe Cash Register Stand, 30" L, 30" D, 35" H, portable with locking cash drawer, foot rest & cash register cord hole, 16 gauge stainless steel top with interchangeable laminate body panels, swivel casters (2 locking)

1 ea Model RSEXTSS-CA Stainless steel exterior for cash stand units

1 ea Model RAN INV30-S Inverted Round Tray Slide, 10" deep, server side

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

## ITEM 27 - SERVING COUNTER, UTILITY (1 REQ'D)

Randell Model RAN ST-2 Dimensions: 35(h) x 24(w) x 30(d) RanServe Utility Unit, 24" L, 30" D, 35" H, mobile modular, enclosed base, 16 gauge stainless steel top, laminate exterior with galvanized backing

- 1 ea Model RSEXTLAM-24 Laminate Exterior (specify color), for 24" units
- 1 ea 6" swivel casters (2 locking), standard

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

# ITEM 28 - COLD PAN SERVING COUNTER (2 REQ'D)

Randell Model RAN SCA-3S Dimensions: 35(h) x 48(w) x 30(d)

RanServe Cold Food Table, refrigerated cold pan, 48" L, 30" D, 35" H, mobile modular, 3-pan size, open base, 16 gauge stainless steel top, laminate exterior with galvanized backing, swivel casters (2 locking), 1/4 HP

- 2 ea 115v/60/1-ph, 5.0 amps, NEMA 5-15P, standard
- 2 ea Model RSEXTLAM-48 Laminate Exterior (specify color), for 48" units
- 2 ea Model RAN SGS48 Single-Tier Overshelf, 48" L with 6" adjustable sneeze guard
- 2 ea Model RSBORSWB-48 Stainless steel work board, 48" length, server side
- 2 ea Model RAN INV48-C Inverted Round Tray Slide, 10" deep, customer side
- 2 ea 6" swivel casters (2 locking), standard

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

ITEM 29 - SERVING COUNTER, UTILITY (1 REQ'D)

Randell Model RAN ST-3 Dimensions: 35(h) x 36(w) x 30(d) RanServe Utility Unit, 36" L, 30" D, 35" H, mobile modular, enclosed base, 16 gauge stainless steel top, laminate exterior with galvanized backing

- 1 ea Model RSEXTLAM-36 Laminate Exterior (specify color), for 36" units
- 1 ea Model RAN SGS36 Single-Tier Overshelf, 36" L with 6" adjustable sneeze guard
- 1 ea Model RSBORSWB-36 Stainless steel work board, 36" length, server side
- 1 ea Model RAN INV36-C Inverted "V" Tray Slide, 10" deep, customer side
- 1 ea 6" swivel casters (2 locking), standard

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

ITEM 30 - HOT FOOD SERVING COUNTER (2 REQ'D)

Randell Model RAN HTD-4S Dimensions: 35(h) x 60(w) x 30(d) RanServe Hot Food Table, electric, 60" L, 30" D, 35" H, mobile modular, (4) 12" x 20" hot food wells,

open cabinet base with sliding doors, 16 gauge stainless steel top, laminate exterior with galvanized backing, swivel casters (2 locking)

2 ea	208v/60/1-ph, 21.2amps, NEMA 6-30P
2 ea	Model RSEXTSS-60 Stainless steel exterior, for 60" units
2 ea	Model RSTOP14G60 Top, 14 gauge stainless steel 60" unit
2 ea	Model RAN CP60-SS Counter Protector, for 60" units, with stainless steel top
2 ea	Model RSBORSWB-60 Flat Work Board, 60", stainless steel server side
2 ea	Model RAN INV60-C Inverted Round Tray Slide, 10" deep, customer side
2 ea	6" swivel casters (2 locking), standard

Acceptable Manufacturers: RANDELL, MULTITERRIA, LOW TEMP INDUSTRIES

access panel & enclosed bottom, basket drain, wall brackets, NSF, cCSAus

ITEM 31 - HAND SINK (2 REQ'D)

Advance Tabco Model 7-PS-41 Dimensions: 27(h) x 20(w) x 24(d) Hand Sink, tapered bowl design, wall mounted, 14" wide x 16" front-to-back x 5" deep bowl, 18 gauge 304 stainless steel, electronic faucet (battery & 110v options both supplied), deck mounted soap dispenser (pump), undermounted front-loading paper towel dispenser, stainless steel skirt with removable

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

- ITEM 32 SPARE NO. <Spare No.>
- ITEM 33 SPARE NO. <Spare No.>
- ITEM 34 SPARE NO. <Spare No.>
- ITEM 35 SPARE NO. <Spare No.>

ITEM 36 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)

Advance Tabco Model VSS-4812 Dimensions: 35.5(h) x 144(w) x 48(d) Work Table, 144"W x 48"D, 14 gauge 304 stainless steel top with countertop non drip edge, adjustable stainless steel undershelf, stainless steel legs & adjustable bullet feet, NSF

2 ea Model TA-62D Electric outlet in doghouse box on top of table or overshelf, GFI, duplex, in 'doghouse-style' single gang box, NEMA 5-20R receptacles, stainless face plate, maximum 120v 20A service (wiring & utility chases or provisions not included) (optional chases and/or wiring by Advance Tabco is available-call for pricing)

2 ea Model TA-62E Upgrade electric outlet to NEMA 6-20R or equivalent, maximum 240v 20A service (typically used for 208/240v applications), single receptacle in box, (wiring & utility chases or provisions not included) (optional chases and/or wiring by Advance Tabco is available-call for pricing) (requires TA-62A, TA-62C or TA-62D option)

1 ea Weld-In sink - single bowl

- 1 ea Model TA-11F Sink Welded Into Table Top, 10"W x 14"D x 10" deep bowl, includes faucet, NSF (must specify sink location)
- 1 ea Model K-400 Hands-Free Wand Attachment, for hand washing sink
- 1 ea Model K-12 Soap Dispenser, deck mounted (for use with hand sinks & drop in hand sinks with deck mounted faucets only)
- 1 ea Weld-In sink double bowl

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

1 ea	Model TA-56 5" tall NSF partition
2 ea	Model ADT-2-2020 Drawer Assembly, (2) tier, 20"W x 20"D x 5" deep removable stain- less steel drawer inserts, roller bearing drawer slides, self closing drawers with noise con- trol, concealed side panels, 430 stainless steel, all TIG welded & fully assembled, NSF
1 ea	15" wide
1 ea	Model OTS-15-144 Overshelf, table mounted, single, 144"W x 15"D, 18 gauge 430 stain- less steel (non-adjustable, old style)

1 ea Center of table shelf location

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 37 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D) Advance Tabco Model TVSS-367 Dimensions: 35.5(h) x 84(w) x 36(d) Work Table, 84"W x 36"D, 14 gauge 304 stainless steel top with countertop non drip edge, stainless steel legs with side & rear cross rails, adjustable stainless steel bullet feet, NSF

3 ea Model TA-62D Electric outlet in doghouse box on top of table or overshelf, GFI, duplex, in 'doghouse-style' single gang box, NEMA 5-20R receptacles, stainless face plate, maximum 120v 20A service (wiring & utility chases or provisions not included) (optional chases and/or wiring by Advance Tabco is available-call for pricing)

3 ea Model TA-62E Upgrade electric outlet to NEMA 6-20R or equivalent, maximum 240v 20A service (typically used for 208/240v applications), single receptacle in box, (wiring & utility chases or provisions not included) (optional chases and/or wiring by Advance Tabco is available-call for pricing) (requires TA-62A, TA-62C or TA-62D option)

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 38 - PAN RACK, BUN (4 REQ'D)

Cres Cor Model 207-1820 Dimensions: 69.75(h) x 22.44(w) x 29.63(d) Utility Rack, mobile, angle ledge, full height, open sides, welded pan slides with extruded angles, 3" centers, (40) 14" x 18" tray or (20) 18" x 26" pan capacity, end loading, fully welded Hi-Tensile aluminum frame construction, (4) 5" swivel casters (2) braked, NSF

4 ea Standard Warranty: 3 yr parts, 1-year labor warranty, lifetime guarantee against rust & corrosion

Acceptable Manufacturers: CRESCOR, ADVANCE, JOHN BOOS

# ITEM 39 - CAN RACK (2 REQ'D)

New Age Model 1250 Dimensions: 71(h) x 25(w) x 35(d) Can Storage Rack, stationary design with adjustable feet, sloped glides for automatic can retrieval, aluminum construction, holds 162-#10 cans or 216-#5 cans, NSF

2 ea Lifetime warranty against rust & corrosion, 5 year construction warranty, standard

Acceptable Manufacturers: NEW AGE, ADVANCE, JOHN BOOS

ITEM 40 - PLASTIC WITH METAL FRAME SHELVING (16 REQ'D)

Metro Model MQ2472G Dimensions: 72(w) x 24(d)

MetroMax Q<sup>™</sup> Shelf, 72"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

- 16 ea Model MX63UP Polymer trilobal post (compatible with MetroMax i, MetroMax 4, Metro-Max Q), 61-3/16"H, for use with stem casters, adjusts at 1" increments, corrosion proof all polymer construction with built in Microban® antimicrobial product protection
   8 ea Model 5MPX Stem Caster, swivel, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)
- 8 ea Model 5MPBX Stem Caster, brake, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

### ITEM 41 - PLASTIC WITH METAL FRAME SHELVING (16 REQ'D)

Metro Model MQ2460G Dimensions: 60(w) x 24(d)

MetroMax Q<sup>™</sup> Shelf, 60"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

- 16 ea Model MX63UP Polymer trilobal post (compatible with MetroMax i, MetroMax 4, Metro-Max Q), 61-3/16"H, for use with stem casters, adjusts at 1" increments, corrosion proof all polymer construction with built in Microban® antimicrobial product protection
- 8 ea Model 5MPX Stem Caster, swivel, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)
- 8 ea Model 5MPBX Stem Caster, brake, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

ITEM 43 - PLASTIC WITH METAL FRAME SHELVING (20 REQ'D)

Metro Model MQ2160G Dimensions: 60(w) x 21(d)

MetroMax Q<sup>™</sup> Shelf, 60"W x 21"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

## ITEM 43 - PLASTIC WITH METAL FRAME SHELVING (8 REQ'D)

Metro Model MQ2460G Dimensions: 60(w) x 24(d)

MetroMax Q<sup>™</sup> Shelf, 60"W x 24"D, open grid polymer with Microban® antimicrobial product protection, epoxy coat steel frame, (4) wedge connectors, NSF

28 ea Model MX63UP Polymer trilobal post (compatible with MetroMax i, MetroMax 4, Metro-Max Q), 61-3/16"H, for use with stem casters, adjusts at 1" increments, corrosion proof all polymer construction with built in Microban® antimicrobial product protection

- 14 ea Model 5MPX Stem Caster, swivel, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)
- 14 ea Model 5MPBX Stem Caster, brake, 5" dia., 1-1/4"W face, high modulus donut wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

- ITEM 44 SPARE NO. <Spare No.>
- ITEM 45 LOCKER BY OTHERS (2 REQ'D)

Winholt Equipment Model WL-4 Dimensions: 13.63(h) x 48(w) x 18(d) BY OTHERS N.I.F.S.C. Lockers, wall mounted, 48"W x 18"D x 13-5/8"H (overall), (4) total lockers, doors are mesh grid, beige finish, includes: garment storage bar, fully assembled

ITEM 46 - SPARE NO. <Spare No.>

## ITEM 47 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)

Advance Tabco Model VSS-300 Dimensions: 35.5(h) x 30(w) x 30(d) Work Table, 30"W x 30"D, 14 gauge 304 stainless steel top with countertop non drip edge, adjustable stainless steel undershelf, stainless steel legs & adjustable bullet feet, NSF

1 st Model TA-255 Casters, expanding adapter, for 1-5/8" dia. O.D. tube/table legs, 400 lb capacity per caster, set of (4) (2 with brakes)

- 1 st Model TA-255B Upgrade heavy duty casters (TA-255, TA-256 only) to have brakes on all wheels (upgrade only, must order casters separately)
- 1 ea Model GZ-1520 Deluxe Drawer, 15"W x 20"D x 5" deep drawer pan insert, galvanized, with drawer slides
- 1 pr Model TA-90 Drawer Adapter/Non Catalog Tables, specify table width (pair)

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 48 - MOP SINK CABINET (1 REQ'D)

Advance Tabco Model 9-OPC-84-300 Dimensions: 84(h) x 25.19(w) x 22.75(d)

Cabinet with Mop Sink, 25-3/16"W x 22-3/4"D x 84"H, mop sink base with drain (bowl 16" x 20" x 12"), left hinged door, (2) mop holders, (1) fixed intermediate shelf, slotted side panels for ventilation, 16/304 series stainless steel sink bowl, 18/304 series stainless steel sink bowl apron, 18/300 series stainless steel cabinet, NSF (right hinged door available on request)

1 ea Model K-240 Service Sink Faucet, wall mount, 8" OC, 6-1/2" spout, with hose thread & pail hook, vacuum breaker spout, wall braced, chrome-plated brass

1 ea Model K-610CF Perforated bottom strainer plate, stainless steel, removable, sits 1" above bottom of sink, fits Advance Tabco Fabricated 16" x 20" sink bowls only

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 49 - HOT WATER DISPENSER (1 REQ'D)

Hatco Model Al Atmospheric Ho tion control, low	WD-12 Dimens ot Water Disper v water cut-off,	ions: 28.13(h) x 13.38(w) x 27.5(d) nser, countertop design, 12-gallon capacity, automatic fill, pushbutton por- electronic temp. control with digital display, stainless steel tank & base, cU-			
Lus, UL EPH C	lassified, ANSI	/NSF 4, Made in USA			
1 ea	NOTE: Sale o sult order ack	f this product must comply with Hatco's Minimum Resale Price Policy; con- nowledgement for details			
1 ea	NOTE: Includes 24/7 parts & service assistance, call 800-558-0607				
1 ea	208v/60/1-ph, 5.0 kW				
1 ea	Standard plug NEMA 6-30P				
3 ea	Model AWD-PLUMB 3 ft. rubber drain hose with 10 ft. 1/4" inlet tubing				
1 ea	Model AWD-FILTER Water filtration system with 10' of 1/4" tubing and fittings				
ITEM 50 -	SPARE NO.	<spare no.=""></spare>			
ITEM 51 -	SPARE NO.	<spare no.=""></spare>			
ITEM 52 -	SPARE NO.	<spare no.=""></spare>			

ITEM 53 - WORK TABLE, STAINLESS STEEL TOP (2 REQ'D)

Advance Tabco Model VSS-305 Dimensions: 35.5(h) x 60(w) x 30(d) Work Table, 60"W x 30"D, 14 gauge 304 stainless steel top with countertop non drip edge, adjustable stainless steel undershelf, stainless steel legs & adjustable bullet feet, NSF

2 ea Model ADT-2-2020 Drawer Assembly, (2) tier, 20"W x 20"D x 5" deep removable stainless steel drawer inserts, roller bearing drawer slides, self closing drawers with noise control, concealed side panels, 430 stainless steel, all TIG welded & fully assembled, NSF

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 54 - SPARE NO. <Spare No.>

ITEM 55 - CAN OPENER (1 REQ'D)

Edlund Model 203/115V

Can Opener, electric, 2-speed (slower speed is ideal for opening smaller cans), recommended usage is up to 75 cans per day, 115v/60/1-ph

1 ea 1 year limited warranty, standard

1 cs Model KT2326 203 & 266 Replacement Parts Kit, includes: (1) G006, (1) K006 and (1) S196 (6 kits per case)

Acceptable Manufacturers: EDLUND OR EQUAL

ITEM 56 - SPARE NO. <Spare No.>

ITEM 57 - SPARE NO. <Spare No.>

## ITEM 58 - MICROWAVE OVEN (1 REQ'D)

Panasonic Model NE-1064F Dimensions: 12(h) x 20.13(w) x 16.5(d)

PRO Commercial Microwave Oven, 1000 Watts, 0.8 cu. ft. capacity, (6) power levels, 2- & 3-stage cooking, 20 program memory capacity, touch control pad with Braille, 99-minute timer, programmable and manual operation, program list/cycle counter, self diagnostics, tone control, bottom energy feed, interior light, stainless steel door, cabinet & cavity, 120v/60/1-ph, 13.4 amps, cord with NEMA 5-15P, UL, ETL, NSF

1 ea 1 year parts & labor warranty (or 18,000 cycles) which ever comes first and 3 year magnatron warranty (or 54,000 cycles) which ever comes first

Acceptable Manufacturers: PANASONIC, AMANA, OR EQUAL

ITEM 59 - SPARE NO. <Spare No.>

ITEM 60 - FOOD PROCESSOR, BENCHTOP / COUNTERTOP (1 REQ'D)

Hobart Model FP150-1 Dimensions: 20.25(h) x 8.25(w) x 18.63(d) Food Processor - Unit Only, angled continuous feed design, full-size hopper, 14 lb per/min production cap., 420 rpm, stainless steel cutting surfaces, planetary gear transmission, triple safety interlocks, aluminum housing, rubber feet, 120/60/1, 1/2 HP, 4.8 amps, UL, NSF

1 ea Model 15PLTSS-6PACK (6) Plates & Storage Rack, consisting of: (1) 15SLICE-1/16-SS, (1) 15SLICE-5/32-SS, (1) 15SLICE-3/8-SS, (1) 15SLICE-7/32-SS, (1) 15SHRED-5/16-SS, (1) DICEGRD-3/8 & (2) WALL-RACK

Acceptable Manufacturers: HOBART, ROBOT COUP, OR EQUAL

ITEM 66 - SPARE NO. <Spare No.>

ITEM 67 - DUNNAGE RACK (4 REQ'D)

Metro Model HP2260PDMB Dimensions: 12(h) x 60(w) x 22(d) Metro Bow-Tie<sup>™</sup> Dunnage Rack, 22" x 60" x 12"H, slotted, holds up to 3000 lbs., with separate polymer tie for joining racks, Microban® antimicrobial product protection, rust & corrosion proof polymer construction, NSF

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

ITEM 68 - DUNNAGE RACK (2 REQ'D)

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

Metro Model HP2248PDMB Dimensions: 12(h) x 48(w) x 22(d)

Metro Bow-Tie<sup>™</sup> Dunnage Rack, 22" x 48" x 12"H, slotted, holds up to 3000 lb., with separate polymer tie for joining racks, Microban® antimicrobial product protection, rust & corrosion proof polymer construction, NSF

Acceptable Manufacturers: METRO, CARLISLE, OR EQUAL

## ITEM 69 - BUSSING UTILITY TRANSPORT CART, METAL (4 REQ'D)

Lakeside Manufacturing Model 411A Dimensions: 32(h) x 27.63(w) x 16.75(d) Medium Duty Utility Cart, 3-tier, open base, 500 lbs capacity, 15-1/2" x 24" shelf size, 11-1/2" shelf clearance, sound deadening panels, (1) push handle with bumpers, (2) bumpers on front legs, allergen-safe purple bumpers, galvanized steel dolly frame, stainless steel construction, 4" swivel casters, Made in USA

4 ea Casters, 4" swivel, standard

Acceptable Manufacturers: LAKESIDE, ADVANCE, JOHN BOOS

ITEM 70 - TWO (2) COMPARTMENT SINK (1 REQ'D)

Advance Tabco Model 94-2-36 Dimensions: 45(h) x 44(w) x 27(d) Regaline Sink, 2-compartment, 20" front-to-back x 16" wide sink compartments, 14" deep, with 11" high splash, stainless steel legs with welded front-to-rear & adjustable left-to-right cross rails, 1" adjustable bullet feet, 14 gauge 304 stainless steel, overall 27" F/B x 44" L/R, NSF

1 ea 12" spout

1 ea Model K-112 Heavy Duty Faucet, 8" OC, splash mounted with 12" swing spout, lead free

- 2 ea Model K-5 Drain, twist operated, 2" NPT & 1-1/2" IPS outlet connections
- 2 ea Model K-4 Support Bracket, for lever waste drain handle, (1) support required for each lever drain

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

ITEM 70.1 - SHELVING, WALL MOUNTED (2 REQ'D) Advance Tabco Model WS-12-42-16 Dimensions: 10.5(h) x 42(w) x 12(d) Shelf, wall-mounted, 42"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

2 ea Model TA-22A Square edge on overshelf or wall shelf

Acceptable Manufacturers: ADVANCE, JOHN BOOS, EAGLE

END OF SECTION 114000

## SECTION 116143 STAGE CURTAINS AND LIGHT

### **BAFFLES 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. Work under this Section includes, but is not limited to, the following components:
  - 1. Curtain tracks, carriers and hangers.
  - 2. Fabricated stage curtains.
  - 3. Curtains and supports for light baffles.
  - 4. Pipe battens and all required miscellaneous hangers, chain, fittings and hardware for a complete installation.

#### 1.3 QUALITY ASSURANCE

- A. All curtains and baffles and installation shall be the responsibility of a single rigging installer/ manufacturer.
- B. Acceptable Manufacturers/Installers are:
  - 1. Peter Albrecht Corp., Milwaukee, WI
  - 2. Beck Studios, Inc., Milford, OH
  - 3. Hoffend & Sons, Inc., Honeoye, NY
- C. Workmanship: All workmanship and finish must be first-class in every particular and strictly in accordance with the best practice. All work shall be made in accordance with the approved shop drawings. All work made in sections shall be properly laid out and spaced between terminals.

#### 1.4 SUBMITTALS

- A. Submit shop drawings for Architect's approval, in accordance with requirements of Section 01300.
- B. Shop drawings shall indicate dimensioned layouts, plans and sections showing assembly and the installation of components.
- C. Individual components shall be detailed as required to illustrate materials, thicknesses, sizes and methods of assembly or attachment to adjoining components.

### 1.5 JOB CONDITIONS

A. Contractor shall take all measurements he may require at the building. He shall consult with PROJECTION SCREENS 116143/1 of 5
the various other Contractors whose work adjoins his work and he shall be responsible for the proper coordination of all details.

- B. Contractor shall do all drilling and fitting and work of similar character required in the fitting and setting of the materials in place, and he shall do all cutting and fitting required in connection with the fitting of his materials to the adjoining work of other Contractors.
- C. Contractor shall provide all connecting members needed for properly supporting and securing this work to the masonry, joints, walls, structural members, or other parts of the building as may be best suited for each case.

## PART 2 PRODUCTS

## 2.1 MATERIALS

- A. Tracks: The tracks shall be as manufactured by:
  - 1. J.R. Clancy, Inc. of Syracuse, New York.
  - 2. Automatic Devices Co. of Allentown, Pennsylvania.
  - 3. H & H Specialties, South El Monte, CA
- B. Stage Curtain Fabric: The stage curtain fabrics shall be as provided by:
  - 1. K & M Fabrics Inc. Greenville S.C.
  - 2. J L de Ball America Inc., New York N.Y.
  - 3. J B Martin, Quebec, Canada
- C. Light Baffle Fabric: Light baffle fabrics shall be as provided by Astrup , Cleveland, Ohio.
- D. Alternate Materials: In no case will materials of lesser design or workmanship be acceptable. Any Rigging Contractor proposing alternate equipment must providesamples for destructive testing and detailed information to the Architect ten days before the bid opening date. Approval of alternate equipment shall be made by the Architect by addenda prior to the bid.

## 2.2 STAGE CURTAIN TRACKS AND DEVICES

- A. Front Curtain Track
  - 1. Provide Model 280 Tracks as manufactured Automatic Devices Company, Allentown, PA.
  - 2. Tracks: Shall be of 14 gauge galvanized, steel or 11 gauge Aluminum construction entirely enclosed except for slot in bottom, each half to be in one continuous piece except where splicing clamps are required.
  - Each curtain carrier shall be spaced on 12 inch centers and shall be of plated steel construction supported from a ball-bearing by two polyethylene wheels held to ballbearing by rust-proof nickel-plated rivet, such wheels rolling on two separate parallel treads.
  - 4. Each curtain carrier shall consist of a free-moving plated swivel and sufficient trim chain to accommodate curtain "S" hook.
  - 5. End pulley blocks shall be adjustable and shall be equipped with sleeve-bearing adequately guarded.
  - 6. A rubber bumper shall be attached to each curtain carrier to function as noise reducer.

## PROJECTION SCREENS

- 7. The manufacturer shall furnish two end-stops for placement at each track end and a tension floor pulley for increasing or decreasing cord tension.
- 8. Stretch-resistant operating cord shall have fiberglass center and shall be of 3/8" diameter, extra-quality yarn.
- B. Rear Curtain Track
  - 1. Provide Model 142 Black Anodized Tracks as manufactured Automatic Devices Company, Allentown, PA.
  - 2. Tracks: Shall be of 11 gauge galvanized, I-Beam construction consisting of a center rib, top, intermediate and bottom flanges.
  - 3. Each curtain carrier shall be spaced on 12 inch centers and shall be of steel construction to include two nylon-tired ball-bearing wheels rolling on two separate parallel treads.
  - 4. Each curtain carrier shall consist of a free-moving plated swivel and sufficient trim chain to accommodate curtain "S" hook.
  - 5. The manufacturer shall furnish two end-stops for placement at each track end.
  - 6. Provide wand of sufficient length for walk along operation.
- C. Side Curtains: Provide 'Rotodraper' Pivot Arms. Location for the pivots to be determined by the Architect.

## 2.3 STAGE CURTAINS

- A. Front Curtain and Valance Flame Retardant Requirements: Fabric shall be completely immersed, squeezed under pressure and dried in a tenter frame. The fabric shall be processed in conformance with the laws of the State of California, NFPA 701 Small and Large Scale, Boston Fire Department, New York Port Authority, and Commonwealth of Massachusetts. Spray method of flame retardant treatment will not be considered equal. Any material indicating the surface precipitation inherent with this procedure will not be accepted and will be replaced at the Contractor's expense with the proper material as specified.
- B. Cyclorama Stage Curtains Flame Retardant Requirements: All fabrics shall be inherently Flame Retardant. The fabric shall be processed in conformance with the laws of the State of California, NFPA 701 Small and Large Scale, Boston Fire Department, New York Port Authority, and Commonwealth of Massachusetts. Spray method of flame retardant treatment will not be considered equal. Any material indicating the surface precipitation inherent with this procedure will not be accepted and will be replaced at the Contractor's expense with the proper material as specified.
- C. All stage curtains are to have sewed-in pleats to 50 percent fullness reinforced at the top on heavy 3 inch flameproofed polypropylene webbing with #3 brass grommets and #9 "S" hooks 12 inches on center for attaching curtains to track. Front curtains are to have 12" side hems. All selvage edges are to be turned under. Webbing is to be sewed to the curtain with three continuous runs of stitching. All curtains are to have 5 inch bottom hems with zinc-plated #8 jack chain weight

encased in a muslin pocket and sewed inside the bottom hem in such a manner as to hold the chain weight approximately 2 inches above the bottom fold of the curtain.

D. Rear and Side Curtains are to have 6 inch side hems and the other cyclorama curtains are to have 2 inch side hems and all are to have the bottom hems as described above. The overhead border curtains are to have the chain weight omitted.

E. Fabrics:

PROJECTION SCREENS

- 1. Flame Retardant Velour weighing not less than 25 oz. per linear yard.
- 2. Inherently flame retardant Velour weighing not less than 13-1/2 oz. per linear yard.

## 2.4 STAGE CURTAIN

- A. The following curtains shall be made of inherently lame resistant 25 oz. Velour:
  - 1. FRONT CURTAIN
  - 2. VALANCE
- B. The following curtains shall be made of inherently flame resistant 13-1/2 oz. Velour:
  - 1. BORDER CURTAINS
  - 2. SIDE CURTAINS
  - 3. REAR CURTAIN

## 2.5 LIGHT BAFFLES

- A. Light baffle curtains are to be sewn flat, fabricated at the top with a 3" rod pocket, 1" side hems and a 2" pocket in the bottom hem with weight or chain.
- B. Light Diffuser Fabric: Flame Retardant Sheerweave 1000 in the color White, with an average openness of 25%.
- C. Provide a utility curtain rods equal to Kirsch Model # 3702, with 2 supports, one at each end of each rod.

## 2.6 PIPE BATTENS AND TRACK SUPPORTS

- A. All dead-hung tracks are to be supported with 3/16" proof coil chain with spacing of support chain not to exceed 5'0" o.c.
- B. Valance, Borders, and Side curtains are to be fastened to 1" i.d. Schedule 40 steel pipe. Pipes are to be supported with 3/16" proof coil chain with spacing of support chain not exceed 10 feet on center.
- C. Light baffles are to be supported with 2" i.d. Schedule 40 steel pipe rods. Pipes are to be supported with flanges at each end screw fastened to walls.
- D. Any additional steel needed to properly support the tracks, pipes, or battens shall be supplied by the Stage Equipment Contractor.
- E. Battens shall be fabricated as follows:
  - 1. Pipe Battens shall be 1-1/2" nominal diameter schedule 40 pipe. All joints shall be spliced with 18" long sleeves with 9" extending into each pipe and held by two 5/16" rivets, plug weld or ramset on each side of the joint.

## PART 3 - EXECUTION

## 3.1 PREPARATION

A. Fabricate and install items in conformity with all applicable trade practices and manufacturer's recommendations, unless specifically accepted by specifications or drawings.

## PROJECTION SCREENS

- B. Carry out shop welding in full conformity with applicable AISC and ASA standards.
- C. Comply with local codes. In absence of local codes, comply with AISC, NEC, and ASA standards as applicable.

## 3.2 INSTALLATION

- A. Consult and coordinate work with trades doing adjoining work.
- B. Use only qualified riggers for installation of lines and trimming and adjustment.
- C. Do all cutting, drilling, tapping, and welding necessary to properly install work.
- D. Use fittings and clips conforming with cable manufacture's recommendations as to size, number, and method of installation. Form rope and cable eyes over properly sized thimbles at requisite connection points.
- E. Position items accurately as indicated on drawings and true to plumb line and level.
- F. Curtains are to be installed on their proper tracks and battens and trimmed to the floor in the best manner known to the profession.
- G. Provide completed installation, ready for satisfactory operation, prior to tests and inspection. Advise the Architect in writing that the installation is completed and ready for acceptance tests and inspection.

END OF SECTION

SECTION 116623 - GYMNASIUM EQUIPMENT

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Basketball equipment.
  - 2. Volleyball equipment.
  - 3. Safety pads.
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for installation of floor insert sleeves or oversized recessed voids to be cast in concrete slabs and footings.
  - 2. Section 096466 "Wood Athletic Flooring" for game lines and markers.

#### 1.3 DEFINITIONS

- A. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).
- B. NCAA: The National Collegiate Athletic Association.
- C. NFHS: National Federation of State High School Associations.
- D. USAV: USA Volleyball.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
  - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For gymnasium equipment.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
  - 3. Include transport and storage accessories for removable equipment.

- C. Samples for Initial Selection: For each type of gymnasium equipment.
- D. Samples for Verification: For the following products:
  - 1. Basketball Net: Full size.
  - 2. Volleyball Net: Minimum 12-inch (305-mm) length by full height, including one edge and net accessories.
  - 3. Pad Fabric: Wall padding not less than 3 inches (76 mm) square, with specified treatments applied. Mark face of material.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.
- B. Qualification Data: For Installer.
- C. Product Certificates: For each type of gymnasium equipment.
- D. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

## 1.9 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Basketball backboard failures including glass breakage.
    - b. Faulty operation of basketball backstops.
  - 2. Warranty Period: 25 years from date of Substantial Completion.

#### PART 2 - PRODUCTS

- 2.1 MANUFACTURERS, GENERAL
  - A. Source Limitations: Obtain gymnasium equipment from single source from single manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 2.3 BASKETBALL EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AALCO Manufacturing
  - 2. Draper, Inc.
  - 3. Performance Sports Construction Group
  - 4. Porter Athletic
  - 5. Spaulding Equipment
- B. General: Provide equipment complying with requirements inNCAA's "Men's and Women's Basketball Rules."
- C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.
- D. Provide manufacturer's recommended connections complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.
- E. Overhead-Supported, Wall-Braced Backstops:
  - 1. Folding Type (Main Court & Side Wall Opposite Bleachers): Provide manufacturer's standard assembly for forward-folding, rear-braced backstop, with hardware and fittings to permit folding.
  - 2. Folding Type (Side Wall Above Bleachers): Forward-folding, front-braced backstop with hardware and fittings to permit folding.
  - 3. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
    - a. Center-Mast Frame: Welded with side sway bracing.
    - b. Finish: Manufacturer's standardpolyester powder-coat finish.

- 4. Goal Height Adjuster: Adjustable from 8 to 10 feet (2.4 to 3 m) with gear-drive mechanism, locking in any position within adjustment range, with visible height scale attached to side of framing.
  - a. Operation: Manual with detachable crank handle.
- F. Backstop Safety Device: Designed to limit free fall if support cable, chains, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb (2722-kg) load capacity; one per folding backstop.
  - 1. Retractor Device: Manufacturer's standard device designed to retract both support and safety cables, chains, and straps away from play of the basketball when backstop is in playing position; one per folding backstop.
- G. Backstop Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
  - 1. Electrical Components, Devices and Accessories: Listed and pabeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
  - 3. Operator Mounting: Wall mounted board.
  - 4. Motor Electrical Characteristics:
    - a. Voltage: 120V
      - b. Horsepower: <sup>3</sup>/<sub>4</sub> hp
    - c. Phase: Single.
  - 5. Remote-Control Station(s): NEMA ICS 6, Type I enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control, with up, down and off functions.
    - a. Group Key Switch Control Stations: One switch per each backstop.
    - b. Keys: Provide two keys per station.
    - c. Switches: Ganged: Single faceplate with multiple switch cut-outs.
- H. Basketball Backboards:
  - 1. Shape and Size:
    - a. Rectangular, 72 by 42 inches (1800 by 1067 mm) width by height.
  - 2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
    - a. Glass: Not less than 1/2-inch-(13-mm-) thick, transparent tempered glass complying with ASTM C 1048 Kind FT (fully tempered) and with impact testing requirements in 16 CFR 1201 Category II or ANSI Z97.1 Class A for safety glazing. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, painted steel frame, with steel subframe, reinforcement, bracing, and mounting slots for mounting backboard frame to backboard support framing.

- 1) Standard Mount: Provide steel corner reinforcement with mounting slots for mounting backboard frame to backstop at standard mounting centers. Provide center-strut frame reinforcement.
- 2) Rim-Restraining Device: Complying with NCAA and NFHS rules and designed to ensure that basket remains attached if glass backboard breaks.
- 3. Target Area and Border Markings: Permanently etched in white color, marked in manufacturer's standard pattern and stripe width.
- I. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern5 inches (127 mm) o.c. horizontally and 4 inches (102 mm) o.c. vertically for goal attachment.
  - 1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.
  - 2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard, and rigidity and stability of goal are maximized.
- J. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
  - 1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication per manufacturer's standard design.
  - 2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
  - 3. Field Adjustment: Provide rim that is field-adjustable for rebound elasticity without being removed from the backboard.
  - 4. Net Attachment: No-tie loops for attaching net to rim without tying.
  - 5. Finish: Manufacturer's standard finish.
- K. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (380 to 460 mm) long, sized to fit rim diameter, and as follows:
  - 1. Competition Cord: Antiwhip, made from white nylon cord not less than 120-gm thread and not more than 144-gm thread.
- L. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports per manufacturer's standard design.
  - 1. Attachment: Manufacturer's standard.
  - 2. Color: As selected by Architect from manufacturer's full range.

## 2.4 VOLLEYBALL EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AALCO Manufacturing.
  - 2. Draper, In c.
  - 3. Performance Sports Systems
  - 4. Porter Athletic, Inc.

- 5. Spaulding Equipment.
- B. General: Provide equipment complying with requirements in NCAA's "Women's Volleyball Rules and Interpretations."
- C. Floor Insert: Chrome-finished steel floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than 9 inches (228 mm) long to securely anchor pipe sleeve below finished floor in concrete footing; with anchors designed for securing floor insert to floor substrate indicated.
  - 1. Quantity: 1 set of floor inserts.
  - 2. Floor Plate: Lockable swivel access cover, designed for use with floating wood floors and to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.
- D. Post Standards: Removable, paired volleyball post standards as indicated. Adjustable, telescoping height. Designed for easy removal from permanently placed floor insert supports. Fabricated from extruded-aluminum pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring. Finished with manufacturer's standard factory-applied, polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.
  - 1. Nominal Pipe or Tubing Diameter: 3-1/2-inch (89-mm) OD at base.
  - 2. Telescopic and Net Height Adjuster System: Provide incrementally adjustable system with predrilled holes and pin manufacturer's standard telescoping system with locking device, telescopic post, and fittings for holding net at selected height; designed for height adjustment of post standard to position net at heights indicated.
    - a. Net Heights: Betweentennis net height and boys'/men's volleyball net height, 42 and 95-5/8 inches (1067 and 2430 mm) or more.
  - 3. Height Markers: Clearly marked at regulation play heights for elementary school girls/women, boys/men tennis.
- E. Net: <u>32 feet</u> (9.75 m) long; one per pair of paired post standards; and as follows:
  - 1. Width and Mesh: Competition volleyball net, <u>36 inches</u> (910 mm) <u>39 inches</u> (990 mm) with <u>4-inch-(102-mm-)</u> square knotless mesh made of black nylon string.
    - a. Hem Band Edges: White, not less than 2-inch-(50-mm-)wide top, bottom, and side bindings; tie offs at top, bottom, and midpoint of each side end of net not less than 1-inch-(25-mm-)wide tension straps at top, bottom, and midpoint of each side end of net; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post standard spacing indicated on Drawings.
      - 1) Top Line: Not less than 1/8-inch-(3-mm-)diameter, galvanized- or coated-steel cable.
      - 2) Bottom Line: Not less than 1/4-inch-(6-mm-)diameter rope.
  - 2. Dowels: Not less than 1/2-inch-(13-mm-)diameter fiberglass or 1-inch-(25-mm-)diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.

- 3. Net Antennas: 3/8-inch-(9.5-mm-)diameter, high-tensile-strength, extruded-fiberglass or plastic rods, 72 inches (1800 mm) long, extending above top hem band of net, with alternating white and red bands according to competition rules. Provide two antennas per net.
  - a. Clamps: Designed to secure antenna to top and bottom of net.
- 4. Boundary Tape Markers: 2-inch-(50-mm-) wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook-and-loop attachment. Provide two tape markers per net for marking court boundaries.
- F. Net-Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Mount net tensioner on post standard at side away from court. Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.
- G. Bottom Net Lock Tightener: Provide manufacturer's standard quick-release-type tension strap; a spring-loaded, self-locking tensioner; a turnbuckle; a pulley; or other device and linkage fittings designed to quickly and easily tighten bottom line or net.
- H. Judges' Stands: Provide manufacturer's standard units designed to be freestanding, folding for storage with wheels for transporting. Fabricate welded-steel tubing units with finish and color to match post standards.
- I. Safety Pads: Comply with NCAA and NFHS requirements. Provide pads consisting of not less than 1-1/4-inch-(32-mm-)thick, multiple-impact-resistant manufacturer's standard foam filler covered by puncture- and tear-resistant fabric cover, not less than 14-oz./sq. yd. (475-g/sq. m) nylon-reinforced PVC; with fire-test-response characteristics indicated. Provide pads with hook- and-loop closure or attachments for the following components:
  - 1. Post Standards: Wraparound style, designed to totally enclose each standard to a height of not less than 66 inches (1680 mm) 72 inches (1800 mm); one per post.
  - 2. Net Lines: Four per net.
  - 3. Judges' Stands: Designed to totally enclose each unit.
  - 4. Fabric Cover Flame-Resistance Ratings: Complies with NFPA 701.
  - 5. Fabric Color: As selected by Architect from full range of industry standard colors and color densities.
  - 6. Graphics: Custom graphics as indicated.
- J. Post Standard Transporter: Manufacturer's standard wheeled unit designed for transporting a single post.
- K. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch-(910-mm-)wide door openings. Fabricate welded-steel tubing units with heavy-duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

## 2.5 SAFETY PADS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AALCO Manufacturing
  - 2. Draper, Inc.
  - 3. Performance Sports Systems
  - 4. Porter Athletic Inc.
  - 5. Spaulding Equipment
- B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tearresistant, PVC-coated polyester or nylon-reinforced PVC fabric, not less than 14-oz./sq. yd (475-g/sq. m) and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.
- D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
  - 1. Backer Board: Not less than 3/8-inch-(9.5-mm-)thick plywood, mat formed, or composite panel.
  - 2. Fire-Resistive Fill: Multiple-impact-resistant foam not less than 2-inch-(50-mm-)thick, fire-resistive neoprene; 6.0-lb/cu. ft. (96-kg/cu. m) density.
  - 3. Size: Each panel section, 24 inches (600 mm) wide by not less than 72 inches (1800 mm) long.
  - 4. Number of Modular Panel Sections: As indicated.
  - 5. Installation Method: Concealed mounting Z-clips and 1-inch (25-mm) bottom fabric attachment flange with exposed fasteners.
  - 6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color(s).
- E. Cut-out Trim: Provide manufacturer's standard flanged cut-out trim kits for fitting pads around switches, receptacles, and other obstructions.

## 2.6 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
  - 1. Extruded Bars, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  - 2. Cast Aluminum: ASTM B 179.
  - 3. Flat Sheet: ASTM B 209 (ASTM B 209M).
- B. Steel: Comply with the following:
  - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
  - 3. Steel Sheet: ASTM A 1011/A 1011M.

- C. Support Cable: 1/4-inch-(6-mm-)diameter, 7x19 Manufacturer's standard galvanized-strandedsteel wire rope with a breaking strength of 7000 lb (3175 kg). Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.
- D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, zinc-plated steel connectors and hangars.
- E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.
- F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.
- G. Softwood Plywood: DOC PS 1, exterior.
- H. Equipment Wall-Mounted Board: Wood, neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.
- I. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.
- J. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
  - 1. Verify critical dimensions.
  - 2. Examine supporting structure, subfloors, and footings below finished floor.
  - 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.
- C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
  - 1. Floor Insert Location: Coordinate location with application of game lines and markers.
  - 2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and floor-plate type.
  - 3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
- D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs and footings. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.
- E. Wall Safety Pads: Mount with bottom edge at 4 inches (102 mm) above finished floor.
- F. Cut-out Trim: Limit cuts in face of padding from trim unit's corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.
- G. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.
- H. Connections: Connect electric operators to building electrical system.
- I. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect, and store units in location indicated on Drawings.

## 3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

## 3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

# 3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

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## SECTION 11 66 43

## <u>NEVCO INC MODEL 2700</u> <u>INTERIOR ELECTRONIC BASKETBALL-VOLLEYBALL-WRESTLING SCOREBOARD</u>

## PART 1 - GENERAL

## **1.1 SUMMARY**

- A. Section includes: Interior, electronic, multi-sport [basketball] [multi-purpose basketball/volleyball/wrestling] scoreboard[s] including control center, and other accessories for complete functional installation.
  - 1. Section 11 66 23 Gymnasium Equipment
  - 2. Section 26 20 00 Low Voltage Electrical Distribution
  - 3. Section 27 41 16 Integrated Audio-Video Systems
  - 4. Section 10 14 63 Electronic Message Signage

## **1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM) Publications:
  - 1. ASTM B221 Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- B. National Electrical Code.
- C. Federal Communications Commission, Part 15 Rules & Regulations.
- D. UL and C-UL Standard for Electric Signs

## **1.3 SUBMITTALS**

- A. Provide in accordance with Section 01 33 00 Submittal Procedures:
  - 1. To minimize the environmental impact of multiple paper copies, product installation prints, instructions and diagrams of manufacturer will be submitted in a paperless fashion. The end user shall receive all pertinent hard-copy documentation at delivery.
  - 2. Product data for scoreboards, controls, and accessories shall include descriptions of control functions etc.
  - 3. Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage. (Paperless when applicable).
  - 4. Copy of guarantee required by Paragraph 1.5 for review by Architect. (Paperless when applicable).
  - 5. Manufacturer's installation instructions. (Paperless when applicable).
  - 6. Finish Samples.

## **1.4 QUALITY ASSURANCE**

- A. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
- B. Manufacturer qualifications: Company specializing in manufacturing electronic scoreboards with 10 years minimum successful world-wide experience.
- C. Scoreboards and other electrical components shall be certified for use in United States and Canada by Underwriter Laboratories, (UL), Inc. and shall bear either UL or C-UL label only.
- D. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

## **1.5 GUARANTEE**

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- A. Provide under provisions of Section 01 78 00 Closeout Submittals: Guarantee to cover defects in materials and workmanship.
  - Scoreboards, scoring tables, marquees, message centers, video boards\* and Stadium Pro loudspeaker enclosures are guaranteed for a period of five (5) years from the date of invoice against defects in workmanship or materials. \*\*Video Board exclusions include 8815, 8825, 8835, 8845.
  - 2. Wireless components, portable scoreboards and solar power kit carry a two (2) year guarantee from date of invoice. Hand-held controls and switches carry a one (1) year guarantee from date of invoice. The Stadium Pro loudspeaker front printed scrim is guaranteed for one (1) year from the date of invoice. Video Board Models 8815, 8825, 8835, and 8845 are guaranteed for one (1) year from date of invoice, unless additional years of warranty is purchased. For products supplied by third-party suppliers (i.e. cameras, computers, computer monitors, radar guns, loudspeakers, amplifiers and associated electronics), Purchaser agrees to accept the manufacturer's warranty, if any, in lieu of any warranty by Nevco.
  - 3. Lifetime telephone support.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

- A. Nevco Inc, 301 East Harris Avenue, Greenville, Illinois 62246; 800-851-4040; www.nevco.com.
- B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 25 00 Product Substitution Procedures.

## **2.2 MATERIALS**

- A. Aluminum face and perimeter frame: Fabricated from [0.050] [inch] [1.3] [mm] minimum thickness, ASTM B221 aluminum sheet.
- B. Finish: Acrylic polyurethane paint. Color as selected by Architect from manufacturer's standard range. [Color to be [No. 70 Desert Tan] [No. 72 Electronic Blue] [No. 73 Maroon] [No. 74 Forest Green] [No. 76 Print Black] [No. 95 Silver Gray] [No. 99 Golden Yellow] [No. 102 Team Orange] [No. 103 Cardinal Red] [No. 104 Medium Purple] [No. 120 Teal Blue] [No. 121 Midnight Blue] [No. 140 Royal Blue] [No. 141 Navy Blue] [No. 142 Kelly Green] as provided by Nevco Inc.] [PMS Color No. ]
- C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.
- D. Provide fiber optic communication interface to reduce threat of damage from electrical storms.
- E. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
- F. Provide location specific universal power cord with plug for world-wide installation.
- G. Control cable where required shall be UL listed, 2-wire, type RG-58/U, coaxial cable, [1/4 inch] [6 mm] diameter.
- H. Junction boxes where required: Sheet metal box and cover, [4-1/2 x 2-1/8 x 2-1/8 inches] [114 x 54 x 54 mm] min. complying with NEMA standards.

## **2.3 SCOREBOARDS**

A. Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, LED displays for time, scores, period, bonus, double bonus, and next possession arrows; Model 2700-NL (Non-Lit caption plates, base model) as manufactured by Nevco Inc. Rear-lit (RL) caption plates or Electronic Team Names (ETN) are optional and scoreboard shall be capable of in-the-field retrofit. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No

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captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.

- 1. Size: [8 feet long x 3 feet high x 8 inches deep.] [2.4 m long x .9 m high x 203 mm deep.]
- 2. Approximate hanging weight: [71 pounds] [32 kg].
- 3. Large black and white captions providing maximum visibility:
  - a. [6 inches] [152 mm] high: "Home", "Guests", and "period".
- 4. LED displays:
  - b. Timing: Super Bright Red [13 inches] [330 mm] high digits.
  - c. Team scores: Super Bright Amber [13 inches] [330 mm] high digits.
  - d. Period: Super Bright Amber [9 inches] [229 mm] high digits.
  - e. Next possession: Super Bright Amber arrow for each team.
  - f. Include bonus and double bonus in the form of a [4 inch] [101 mm] Super Bright Red LED "B".
- 5. Rear-lit captions (when specified) shall require zero maintenance.
- 6. Provide Advertising /Team logo area 12" x 12" minimum.
- 7. Suspension mounting attachments will be included.
- 8. Power requirement: All options included: 126 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.

## 2.4 ACCESSORIES/OPTIONS

- A. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware, and other accessories as required for installation are to be provided by others.
- B. Electronic Team Names: "HOME" and "GUEST" caption plates to be replaced with programmable Electronic Team Names as manufactured by Nevco Inc.
  - 1. Specify changeable team names as ETN. Shall not require controller upgrade, use of additional accessories, or computer.
  - 2. Specify (R)ed or (A)mber ETN LED's (Example: 27xx ETN-R)
- C. Provide rear-lit caption plate option. Specify [RL]. (Model Example: 27xx-RL)
- D. Provide for optional Team Name in place of "HOME" if NL/RL is selected.
- E. Additional accessories include but are not limited to; please specify quantity required.
  - 1. Nevco Inc. Shot Clocks / End of Period (EOP) system.
  - 2. Nevco Inc. Stats Panels
  - 3. Protective Nets/Screens.
  - 4. Nevco Inc. "A", "AD", or "ADL" signs including Artwork with unlimited amount of color.
  - 5. Nevco Inc. Locker Room Clocks.
  - 6. Nevco Inc. Full Color, Red or Amber Message Centers.
  - 7. Nevco Inc. Video Displays.

## 2.5 CONTROL CENTER

- A. Type: Wired, microprocessor based operator's control center designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPC as manufactured by Nevco Inc.. Console will operate earlier scoreboards from Nevco Inc..
  - 1. Console: High impact, break-resistant gray plastic [11 x 9-1/2 x 4-1/8 inches] [279 x 241 x 105 mm].
  - 2. Features:
    - a. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
    - b. Split and raised 40 key keyboard, internal beeper acknowledging each entry, and bookmark capabilities.
    - c. Keyboard overlays for scoreboard or accessory.
    - d. Remote hand-held main time switch with integral horn button.

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- e. [25 feet] [7.6 m] control cable with connectors.
- f. Timer features: Time of day display, multiple time out timers with warning, interval horn, up-count auto stop with horn, and 1/10<sup>th</sup> second display during last minute.
- g. Dimmer control for scoreboard.
- 3. Power requirements: 120 volts, 12 watts, 50/60 Hz.
- 4. Provide option of battery supply for control operation if utility power not available.
- 5. Provide carrying case for control center, cable, and hand-held switch; Model CC-3 as manufactured by Nevco Inc..
  - a. Size: [18-1/2 x 14-1/2 x 6 inches] [470 x 368 x 152 mm].
  - b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.
- B. **Type: Wireless**, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay; Model MPCW as manufactured by Nevco Inc.. Console will operate earlier scoreboards from Nevco Inc..
  - 1. Unit shall comply with Part 15 of FCC Rules regarding interference.
  - 2. Console: High impact, break-resistant gray plastic [11 x 9-1/2 x 4-1/8 inches] [279 x 241 x 105 mm].
  - 3. Features:
    - a. Control can be used to operate both wireless and wired scoreboards.
    - b. Power on-off switch.
    - c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
    - d. Keyboard overlays for scoreboard or accessory.
    - e. Remote hand-held main time switch with integral horn button.
    - f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
    - g. Timer features: Time of day display, multiple time out timers with warning, interval horn, upcount auto stop with horn, and 1/10<sup>th</sup> second display during last minute.
    - h. Dimmer control for scoreboard.
  - 4. Receiver: Sturdy impact resistant construction, [6 x 4 x 1.5 inches] [152 x 102 x 38 mm] with [4 inch] [102 mm] antenna and mounted at scoreboard.
  - 5. Maximum range: [1,000 feet] [305 m] from control center to receiver.
  - 6. Power adapters: Provide for each control center.
    - a. Input: 120 volts, 0.4 amps, 50/60 Hz.
    - b. Output: 9 volts, 1.67 amps, 15 watts.
  - 7. Provide option of battery supply for control operation if utility power not available.
  - 8. Provide carrying case for control center and hand-held switch; Model CC-3 as manufactured by Nevco Inc..
    - a. Size: [18-1/2 x 14-1/2 x 6 inches] [470 x 368 x 152 mm].
    - b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.
- C. **Type: Handheld** wireless, basic, AA battery operated, sport specific, control center with receiver unit mounted at scoreboard; Model MPCX<sub>2</sub> as manufactured by Nevco Inc.. Control will have operability with earlier scoreboards from Nevco Inc..
  - 1. Unit shall comply with Part 15 of FCC Rules and Regulations.
  - Control unit: High impact, break-resistant black ABS plastic Size: 3-1/4" x 5-1/2" x 7/8" (.08 x .14 x .02 m)
  - 3. Features:
    - a. Wireless operation within [1000 feet] [305 m].
    - b. Operate multiple scoreboards simultaneously.
    - c. System allows multiple controllers to link to individual scoreboards.

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- d. High visibility LCD display with a sealed keyboard.
- e. Long battery life with indicator; include two AA batteries.
- f. Single hand operation with a no slip grip.
- g. Built-in belt clip.
- h. Wireless signal strength meter and internal antenna.
- 4. Receiver: Injection molded case, [5-1/2 by 3-3/4 by 2 inches] [140 by 95 by 51 mm] mounted at scoreboard.
- 5. Maximum range: [1,000 feet] [305 m] from control center to receiver.
- 6. Power adapters: Provide for each scoreboard receiver.
  - a. Input: 120 volts, 0.4 amps, 50/60 Hz.
  - b. Output: 9 volts, 1.67 amps, 15 watts.
- 7. Provide carrying case for up to two control centers, Model CC-4 as manufactured by Nevco Inc..
  - a. Size: [18-1/2 x 14-1/2 x 6 inches] [470 x 368 x 152 mm].
  - b. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

## PART 3 - EXECUTION

## **3.1 PREPARATION**

- A. Verify exact scoreboard and control center quantities and junction box locations with Architect.
- B. Coordinate require ments for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards. [Ensure that building roof structure has been designed for loads of suspended scoreboards.]
- C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and boxes are provided. Prior to installation, verify type and location of power supply.

## **3.2 INSTALLATION**

- A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
- B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
- C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
- D. Clean exposed surfaces.
- E. Protect scoreboards and finishes from other construction operations.

## **3.3 DEMONSTRATING AND TRAINING**

A. In accordance with Section 01 75 00 - Starting, Adjusting, and Demonstrating, provide demonstration and training session for Owner's representative covering operation and maintenance of electronic scoreboard.

## END OF SECTION

## SECTION 116800 - PLAY FIELD EQUIPMENT AND STRUCTURES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes playground equipment as follows:
  - 1. Freestanding basketball goal system.

## 1.2 DEFINITIONS

- A. Definitions in ASTM F 1487 apply to Work of this Section.
- B. IPEMA: International Play Equipment Manufacturers Association.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of playground equipment.
  - 1. Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For each type of exposed finish.
  - 1. Manufacturer's color charts.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of playground equipment.
- B. Sample Warranty: For manufacturer's special warranties.

## 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

### 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period:
    - a. Pole and Support Structure: Lifetime.
    - b. Backboard and Rim: Lifetime.

## PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

A. Safety Standard: Provide playground equipment according to ASTM F 1487.

## 2.2 FREESTANDING BASKETBALL GOAL SYSTEM

- A. Basketball Goals:
  - 1. Vertical post and 45" extension arm: 6" 3/16" wall thickness, vertical pole shall be capped.
  - 2. Horizontal support: 4" square galvanized steel, 1/8" wall thickness.
  - 3. Post Setback: 60".
  - 4. Anchorage: Embedded in concrete.
  - 5. Backboard: 42" x 72" formed, 12 ga steel, no exposed shear edges.
  - 6. Rim: double ring, break-away, mounted directly to structural support, 5/8" diameter.
  - 7. Net attachment: 3/16" x 1" continuous, steel, provide nylon nets with goal.
  - 8. Metal Finish: Polyester powder coat.
  - 9. Safety Materials: Backboard and pole padding.

## 2.3 FABRICATION

A. Provide sizes, strengths, thicknesses, wall thickness, and weights of components as required to comply with requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted.

#### 2.4 MATERIALS

A. Steel: Material types, alloys, and forms recommended by manufacturer for type of use and finish indicated, hot-dip galvanized.

- B. Stainless-Steel Sheet: Type 304; finished on exposed faces with No. 2B finish.
- C. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or zinc-plated steel and iron, or stainless steel; permanently capped; and theft resistant.

## 2.5 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in ACI 301/ (ACI 301M) for normal-weight, air-entrained concrete with minimum 28-day compressive strength of 3000 psi (20.7 MPa), 4-inch (76-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate, polypropylene fiber-reinforced.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading required for placing playground equipment and protective surfacing is completed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor equipment securely, positioned at locations and elevations indicated.
- B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.
- C. Post Set with Concrete Footing:
  - 1. Unless specifically noted otherwise, set equipment posts on 1'-0" deep concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set perfectly vertical at the correct angle, alignment, height, and spacing.
    - a. Extend embedded supports 3'-0" minimum into concrete foundation below the bottom elevation of surface materials.
    - b. Foundation diameter shall be 2'-0", depth 4'-0".
    - c. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
  - 2. Finishing Footings: Smooth top, and shape to shed water.

END OF SECTION 116800

## SECTION 122413 - ROLLER WINDOW SHADES

## 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. Manually operated roller shades with single rollers.
  - 2. Motor-operated roller shades with single rollers.
- B. Related Requirements:
  - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type and color of shadeband material.
  - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of roller shade.
  - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark inside face of material if applicable.
  - 2. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.
- E. Roller-Shade Schedule: Use same designations indicated on Drawings.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

#### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.
- 1.9 FIELD CONDITIONS
  - A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Draper, Inc
  - 2. Lutron Electronics Co., Inc.

- 3. MechoShade Systems, Inc.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

#### 2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
  - 1. Bead Chains: Stainless steel.
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
  - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
    - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idleend assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: As recomended by manufacture..
  - 2. Direction of Shadeband Roll: Regular, from back of roller.
  - 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Shadebands:
  - 1. Shadeband Material: Light-filtering fabric.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
- E. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches (76 mm).
  - 2. Endcap Covers: To cover exposed endcaps.
  - 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

## 2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
  - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
    - a. Electrical Characteristics: Single phase, 110 V, 60 Hz.
  - 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
    - a. Keyed Control Station: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
    - b. Color: As selected by Architect from manufacturer's full range.
  - 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
  - 5. Operating Features:
    - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idleend assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: As indicated on Drawings.
  - 2. Direction of Shadeband Roll: Regular, from back of roller.
  - 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- E. Shadebands:
  - 1. Shadeband Material: Light-filtering fabric.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Installation Accessories:

- 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
  - a. Shape: L-shaped.
  - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches (76 mm).
- 2. Endcap Covers: To cover exposed endcaps.
- 3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

## 2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  - 1. Source: Roller-shade manufacturer.
  - 2. Type: PVC-coated polyester.
  - 3. Weave: Basketweave.
  - 4. Roll Width: 98 inches.
  - 5. Orientation on Shadeband: Up the bolt.
  - 6. Openness Factor: 3 percent.
  - 7. Color: As indicated on Drawings.

## 2.5 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
  - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
  - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
  - 2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.
- B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

#### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- 3.4 CLEANING AND PROTECTION
  - A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
  - B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
  - C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

### 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

## SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

#### 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 plastic-laminate countertops.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including, panel products, high-pressure decorative laminate, and adhesive for bonding plastic laminate.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show locations and sizes of cutouts and holes for plumbing fixtures installed in plasticlaminate countertops.
- C. Samples for Verification:
  - 1. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For the following:
  - 1. Composite wood and agrifiber products.
  - 2. High-pressure decorative laminate.
  - 3. Chemical-resistant, high-pressure decorative laminate.
  - 4. Adhesives.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fireretardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

## 2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
  - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP.

## PLASTIC-LAMINATE-CLAD COUNTERTOPS

- D. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:
  - 1. <u>Products</u>: Subject to compliance with requirements, provide one of the following:
    - a. Wilsonart
    - b. Formica group
    - c. Panolam Surface Systems.
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated on drawings by manufacturer's designations.
  - 2. Grain Direction: Parallel to cabinet fronts.
- F. Edge Treatment: Same as laminate cladding on horizontal surfaces on front user edge, with 3mm PVC edge banding on exposed end edges.
- G. Core Material: Medium-density fiberboard made with exterior glue.
- H. Core Material at Sinks: medium-density fiberboard made with exterior glue.
- I. Core Thickness: 3/4 inch (19 mm).
  - 1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- J. Paper Backing: Provide paper backing on underside of countertop substrate.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

## 2.3 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Product: Subject to compliance with requirements, provide " OG series" by Doug Mockett & Company, Inc.
- 2.4 MISCELLANEOUS MATERIALS
  - A. Adhesive for Bonding Plastic Laminate: Contact cement.

#### PLASTIC-LAMINATE-CLAD COUNTERTOPS

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

#### 2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 1. Seal edges of openings in countertops with a coat of varnish.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

## 3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding

24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to walls with adhesive.
  - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

## 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

## SECTION 123661 - SIMULATED STONE COUNTERTOPS

### 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. Solid-surface-material countertops and backsplashes.
- B. Related Sections:
  - 1. Section 064116 "Plastic-Laminate-Faced Architectural Cabinets".
  - 2. Section 123623.13 "Plastic Laminate Clad Countertops".
  - 3. Section 224100 "Residential Plumbing Fixtures" for nonintegral sinks, sinks, and plumbing fittings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Verification: For the following products:
  - 1. Countertop material, <u>6 inches</u> (150 mm) square.

#### 1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.
- 1.5 COORDINATION
  - A. Coordinate locations of utilities that will penetrate countertops or backsplashes.
- PART 2 PRODUCTS
- 2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS
  - A. Configuration: Unless otherwise indicated Provide countertops with the following front and backsplash style:

- 1. Front: 1-1/2" Straight, slightly eased at top.
- 2. Backsplash: Straight, slightly eased at corner.
- 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch-(12.7-mm-) thick, solid surface material.
- C. Backsplashes: 1/2-inch-(12.7-mm-) thick, solid surface material.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
  - 2. Install integral sink bowls in countertops in the shop.

## 2.2 COUNTERTOP MATERIALS

- A. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
  - 1. <u>Manufacturers</u>: Subject to compliance with requirements, provide products by one of the following:
    - a. Corian
    - b. Formica Group
    - c. Wilsonart
    - d. Samsung, Staron
  - 2. Type: Provide Standard Type or Veneer Type made from material complying with requirements for Standard Type, as indicated unless Special Purpose Type is indicated.
  - 3. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
  - 4. Colors and Patterns: As indicated by manufacturer's designations.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- 1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- 2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 126600 - TELESCOPING STANDS

#### 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. Electrically operated telescoping stands.

#### 1.3 DEFINITIONS

- A. Forward Folding: Wall- or floor-attached bleachers that open in the forward direction by moving the front row away from the stack to the fully extended position.
- B. Reverse Folding: Floor-attached bleachers that open in the backward direction by moving the last row away from the stack to the fully extended position.
- C. Freestanding: Being free or away from a permanent wall.

#### 1.4 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 telescoping stands.
  - 2. Include load capacities, assembly characteristics, and furnished accessories.
  - 3. Include electrical characteristics of electrical components, devices, and accessories.
- B. Shop Drawings: For telescoping stands in both stacked and extended positions.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include load capacities.
  - 3. Show seating layout, aisle widths, row-lettering and seat-numbering scheme, and wheelchair accessibility provisions.
  - 4. Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed product and for each color and texture required.
  - 1. Include Samples of accessories involving color and finish selection.

- D. Samples for Verification: For the following products prepared on Samples of size indicated below:
  - 1. Decking: 6-inch-(150-mm-)square Samples of finished material.
  - 2. Metal Components: 6-inch-(150-mm-)square Sample of each color and finish indicated.
  - 3. Seating Material: 6-inch-(150-mm-)square Sample of each seating material, color, and finish indicated.
  - 4. Seat Unit: Full-size unit of each type.
  - 5. Upholstery Fabric: 12-inch-(300-mm-) square Sample of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.
- C. Product Certificates: For each type of telescoping stand assembly.
- D. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For telescoping stands to include in operation and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Procedures for conducting periodic inspections.
    - b. Precautions for cleaning materials and methods that could be detrimental to telescoping-stand finishes and performance.
    - c. Methods for maintaining upholstery fabric.

### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."

#### 1.8 FIELD CONDITIONS

- A. Finished Spaces: Do not deliver or install telescoping stands until finishes in spaces to receive them are complete, including suspended ceilings, floors, and painting.
- B. Field Measurements: Indicate measurements on Shop Drawings.

#### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Telescoping stands shall withstand the effects of gravity loads, operational loads, and other loads and stresses according to ICC 300.

#### 2.2 TELESCOPING STANDS

- A. System Description: Operable system of multiple-tiered seating on interconnected folding platforms that close for storage, without being dismantled, into a nested stack. Telescoping-stand units permit opening and closing of adjacent, individual and multiple rows, and close with vertical faces of platforms in the same vertical plane.
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Telescoping-Stands Standard: ICC 300.
- B. Wall-Attached Telescoping Stands: Forward-folding system, in which the bleachers open in the forward direction by moving the front row away from the stack to the fully extended position and the rear of bleacher understructure permanently attaches to wall construction.
  - 1. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide Maxam26 as manufactured by Hussey Seating or comparable product by one of the following:
    - a. Interkal LLC
    - b. Irwin Seating Company
  - 2. Row Spacing: 24 inches.
  - 3. Row Rise: 9-5/8 inches.
  - 4. Seat Type: Benches.
  - 5. Elevated Front Row: 1-5/16 inches.
  - 6. Operation: Electrically operated, with friction-type, integral power unit, Electrically operated, with non-friction-type, integral power unit.
  - 7. Electrical Characteristics for Each Seating Section:
    - a. Horsepower: 1/2.
    - b. Voltage: 208 V ac , three phase, 60 hertz.
  - 8. Electrical Controls:
    - a. Control Devices: Wall-attached control system.
    - b. Limit Switches: Automatically stop power system when telescoping stands reach fully opened or closed positions.

- c. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 dB at 10 feet (3 m), mounted under telescoping seating for audio and visual warning during operation.
- d. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

## 2.3 COMPONENTS

- A. Benches: Seats and skirts.
  - 1. Material: Molded plastic with contour surfaces.
    - a. Color: As selected by Architect from manufacturer's standard.
  - 2. Bench Height: Not less than 16 inches (406 mm) or more than 18 inches (457 mm).
  - 3. Bench Depth: 10 inches (254 mm).
- B. Deck: Plywood, 5/8 inch (16 mm) thick.
  - 1. Finish: Transparent.
    - a. Color: Manufacturer's standard.
- C. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.
- D. Safety Rails: Steel, finished with manufacturer's standard powder coat system.
  - 1. Self-storing mid-aisle handrails located at centerline of each aisle with seating on both sides.
  - 2. End rails (guards) that are telescoping and self-storing.
  - 3. Removable rails around accessible seating cutouts and truncations.
  - 4. Color: Black.
- E. Understructure: Structural steel.
  - 1. Finish: Alkyd-enamel, two-coat system, rust-inhibiting finish.
  - 2. Color: Manufacturer's standard.
- F. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.
  - 1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 4 inches (100 mm) in diameter and 1-1/2 inch (32 mm) wide.
- G. Control Devices:
  - 1. Wall Attached: Keyed-switch control station, located within full view of each stand and its movement area. Provide two keys per station.
- H. Fasteners: Vibration proof, in manufacturer's standard size and material.

# 2.4 ACCESSORIES

- A. Steps:
  - 1. Slip-resistant, abrasive tread nosings at aisles.
  - 2. Intermediate aisle steps, fully enclosed, at each aisle.
  - 3. Removable front steps, fully enclosed, at each aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.
- B. Closure Panels and Void Fillers:
  - 1. Panels at cutouts and truncations for accessible seating.
  - 2. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
  - 3. Gap fillers for closing openings between stand units or between stand units and adjoining construction.
- C. Signage:
  - 1. Row letters at each row end.
  - 2. Seat numbers at 18 inches (457 mm) o.c. on benches and on each chair.

# 2.5 MATERIALS

- A. Lumber: Kiln dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B & B finish (B and better) grade-of-finish requirements.
- B. Molded Plastic: High-density polyethylene; blow or injection molded, color-pigmented, textured, impact-resistant, with integral reinforcing ribs for attachment and anchoring points. Provide with UV inhibitors to retard fading.

### 2.6 FABRICATION

- A. Fabricate telescoping stands to operate easily without special tools or separate fasteners unless otherwise indicated.
- B. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- C. Form exposed work with flat, flush surfaces, level and true in line.
- D. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.
  - 1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

A. Install telescoping stands according to ICC 300 and manufacturer's written instructions.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. ICC 300 Inspection: Inspect installed telescoping stands to verify that construction, installation, and operation are according to ICC 300 requirements.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Telescoping stands will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.
- B. Adjust hardware and moving parts to function smoothly, and lubricate, test, and adjust each telescoping stand unit to operate according to manufacturer's written instructions.
- C. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up factoryapplied finishes or replace components as required to restore damaged or soiled areas.
- D. Replace upholstery fabric damaged during installation or work of other trades.

#### 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, operate, and maintain telescoping stands.

END OF SECTION 126600

SECTION 129300 - SITE FURNISHINGS

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Seating.
  - 2. Trash Receptacles.
  - 3. Bicycle racks.
  - 4. Bollards.
  - 5. Lighted bollards.

### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.

#### 1.3 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.

### PART 2 - PRODUCTS

#### 2.1 METAL BENCH

- A. Style: 6'-0" long x 2'-2" wide x 1'-3" high bench with cantilevered frame.
- B. Frame: 2-7/8" OD x 12 gage structural steel tube with radius corners.
- C. Seat:
  - 1. Material: Painted, perforated steel sheet.
  - 2. Surface Shape: Flat with rounded edge, both sides.
  - 3. Arms: Two, one at each end, match frame material.
  - 4. Seating Configuration: straight shape.
  - 5. Mounting: Embedded.

D. Finish: Galvanized and PVC coated. Color as selected by Architect from manufacturer's full range color options.

### 2.2 BOLLARDS

- A. Function: Lighted and non-lighted bollards shall be by same manufacturer, same shape and style.
- B. Style: Smooth cylinder with horizontal flutes at top.
  - 1. Size: 6" nominal diameter.
    - a. Outer Diameter Pipe Size: 6.625 inches.
    - b. Wall Thickness: 0.280 inches.
    - c. Height: 33 inches.
  - 2. Mounting:
    - a. Permanently embedded.
  - 3. Lighting:
    - a. LED output 10 lumens.
    - b. Lens: UV stable, impact-resistant translucent acrylic.
    - c. Voltage: 277 VAC.
    - d. Output, horizontal: 360 deg.
    - e. Color Temp: 3500k

#### C. Materials:

1. Bollard Tube: Structural steel tube, ASTM A 500, Grade B.

### 2.3 BICYCLE PARKING FEATURE

- A. Bicycle Rack Construction:
  - 1. Material: Galvanized steel.
    - a. Pipe or Tubing OD: Not less than 2-3/8 inches (60 mm).
  - 2. Style: Ribbon rack.
    - a. Overall Height: 36".
    - b. Capacity: Designed to accommodate no fewer than nine bicycles.
  - 3. Installation Method: Embedded.
- B. Steel Finish: Galvanized, powder coated.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.4 TRASH RECEPTACLES

- A. Steel Facing Surrounds: Steel sheet, evenly patterned, perforated.
- B. Support Frames: Galvanized steel; welded.
- C. Shape and Form:
  - 1. Receptacle: Round cylinder; with opening in top for depositing trash.
  - 2. Tops: Flat rim lid with center opening, permanently secured.
  - 3. Inner Container: Galvanized-steel, sheet Fiberglass or Rigid plastic container with drain holes lift-out handles; designed to be removable and reusable.
  - 4. Disposable Liners: Provide receptacle designed to accommodate disposable liners.
  - 5. Capacity: Not less than 32 gal. (121 L).
  - 6. Service Access: Fixed lid or top, side access; inner container and disposable liner slideout for emptying; lockable with padlock hasps; self-latching hinge.
  - 7. Mounting: Surface mount on concrete.
- D. Steel Finish: Galvanized and PVC-color coated.
  - 1. Color: As selected by Architect from manufacturer's full range.
- E. Fiberglass, HDPE Color: As selected by Architect from manufacturer's full range.

### 2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
  - 1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
  - 2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
  - 3. Structural Pipe and Tube: ASTM B 429/B 429M.
  - 4. Sheet and Plate: ASTM B 209 (ASTM B 209M).
  - 5. Castings: ASTM B 26/B 26M.
- B. Steel and Iron: Free of surface blemishes and complying with the following:
  - 1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
  - 3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
  - 4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513/A 513M, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
  - 5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
  - 6. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
- C. Stainless Steel: Free of surface blemishes and complying with the following:
  - 1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
  - 2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.

- 3. Tubing: ASTM A 554.
- D. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
- E. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
- F. Anchors, Fasteners, Fittings, and Hardware: Stainless steel; commercial quality, tamperproof, vandal and theft resistant, concealed or recessed, and capped or plugged.
  - 1. Angle Anchors: For inconspicuously bolting legs of site furnishings to grade substrate; one per leg.
  - 2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit.
- G. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
  - 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil (0.0076 mm) thick.
  - 2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

#### 2.6 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, fullpenetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

### 2.7 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### 2.8 ALUMINUM FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

### 2.9 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, mattetextured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

#### 2.10 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run directional finishes with long dimension of each piece.
  - 2. Directional Satin Finish: No 4.
  - 3. Dull Satin Finish: No. 6.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for correct and level finished grade, mounting surfaces, 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 installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after paving has been completed.
- C. Install site furnishings level, plumb, true, securely anchored and positioned at locations indicated on Drawings.
- D. Post Setting for Embedded Furnishings: Set cast-in support posts in fiber-reinforced concrete foundations with smooth top, shaped to shed water. Protect portion of posts above footing from

concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.
- G. Anchored Installation: For surface mounted site furnishings requiring anchored installation, use quantity and type of anchoring devices recommended by manufacturer, and subject to Architect's approval. Unless noted otherwise all anchoring devices shall be stainless steel expansion type anchors.
  - 1. Concrete foundations shall extend to frost line or below, minimum 2'-6".
  - 2. Foundation diameter: 1'-0" minimum, formed at top where foundation is exposed.
  - 3. Lower top of foundation to allow pavers to extend over top of foundation where furniture is located in paver areas.

END OF SECTION 129300

# SECTION 142400 - MACHINE ROOM-LESS HYDRAULIC ELEVATORS

### PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the contract, including General and Supplementary Conditions and Division 01 Specifications apply to this section\.

#### 1.2 SUMMARY

- A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
  - 1. Standard pre-engineered hydraulic passenger elevators.
  - 2. Elevator car enclosures, hoistway entrances and signal equipment.
  - 3. Jack(s).
  - 4. Operation and control systems.
  - 5. Accessibility provisions for physically disabled persons.
  - 6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
  - 7. Materials and accessories as required to complete the elevator installation.
- B. Related Sections:
  - 1. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
  - 2. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
  - 3. Division 5 Metals:
    - a. Providing hoist beams, pit ladders, steel framing and auxiliary support steel.
    - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
  - 4. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
  - 5. Division 23: Heating and Ventilation:
    - a. Heating and ventilating hoistways.
  - 6. Division 16 Sections:
    - a. Providing electrical service to elevators. (note: fused disconnect switch to be provided by elevator manufacturer.
    - b. Heat and smoke sensing devices.
    - c. Convenience outlets and illumination in hoistway and pit.
- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Section 300 for hydraulic elevators. State or local requirements must be used if more stringent.
  - 1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
  - 2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
  - 3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
  - 4. Elevator hoistways shall have barricades, as required.
  - 5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
  - 6. Provide rail bracket supports at pit, each floor and roof.
  - 7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.

- 8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
- 9. All wire and conduit should run remote from the hoistways.
- 10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
- 11. Install and furnish finished flooring in elevator cab.
- 12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
- 13. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
- 14. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
- 15. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
- 16. General Contractor shall fill and grout around entrances, as required.
- 17. All walls and sill supports must be plumb where openings occur.
- 18. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
- 19. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1<sup>st</sup> floor. Final location must be coordinated with elevator contractor.
- 20. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
- 21. For signal systems and power operated door: provide ground and branch wiring circuits.
- 22. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
- 23. Controller landing wall thickness must be a minimum of 8 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
- 24. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

### 1.3 SUBMITTALS

- A. Product data: When requested, the elevator contractor will provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
  - 1. Show equipment arrangement in the pit and hoistway. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
  - 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
  - 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
  - 4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Powder Coat Paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and

materials.

- E. Metal Finishes: Upon request, standard metal samples provided.
- F. Operation and maintenance data. Include the following:
  - 1. Owners Manual and Wiring Diagrams.
  - 2. Parts list, with recommended parts inventory.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An approved manufacturer with minimum fifteen years experience in manufacturing, installing, and servicing commercial elevators.
  - 1. Must be the manufacturer of the power unit, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
  - 2. The manufacturer shall have a documented, on-going quality assurance program.
- B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than fifteen years of satisfactory experience installing elevators equal in character and performance to the project elevators.
- C. Regulatory Requirements:
  - 1. ASME/ANSI A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
  - 2. Building Code: 2014 Indiana Building Code.
  - 3. NFPA 70 National Electrical Code.
  - 4. NFPA 80 Fire Doors and Windows.
  - 5. Americans with Disabilities Act Accessibility Guidelines (ADAAG).
  - 6. Seismic Risk Zone: Seismic Design Category "D".
- D. Fire-rated Entrance Assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(B), and NFPA 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).
- E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
  - 1. Arrange for inspections and make required tests.
  - 2. Deliver to the Owner upon completion and acceptance of elevator work.

#### 1.5 DELIVERY, STORAGE AND HANDLING

A. Manufacturing will deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

### 1.6 PROJECT CONDITIONS

A. Prohibited Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

## 1.7 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after completion of installation or acceptance thereof by beneficial use, whichever is earlier.

### 1.8 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours, excluding callbacks. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation.
  - 1. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

#### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: The drawings are based on hoistway and equipment dimensions and other structural, mechanical and electrical requirements of Thyssen Krupp's pre-engineered Machine Room-less "Endura" hydraulic elevators. Any deviations or changes from these requirements by any manufacturer will require the architect's approval. If approved, any and all additional costs related to the changes including redesign costs, if any, will be borne by the Elevator Contractor. Subject to requirements, available manufacturer's offering similar products which may be acceptable are:
  - 1. Otis Elevator Company
  - 2. Schumacher Elevator Company

#### 2.2 MATERIALS, GENERAL

- A. Colors, patterns, and finishes: As selected by the Architect from manufacturer's standard colors, patterns, and finish charts.
- B. Steel:
  - 1. Shapes and bars: Carbon.
  - 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
  - 3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.
- C. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.
- D. Carpet: By others.
- 2.3 HOISTWAY EQUIPMENT
  - A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood subfloor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

- B. Sling: Steel stiles affixed to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
  - 1. Guide Shoes: Slide guides shall be mounted on top and bottom of the car.
  - 2. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on a steel template that is fastened to the pit floor. Provide extensions if required by project conditions.
  - 3. Jack: Jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the Assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section.
  - 4. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the landings and correct for overtravel or undertravel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
  - 5. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper grade readily biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details).
  - 6. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.
  - 7. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

### 2.4 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
  - 1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
  - 2. An oil hydraulic pump.
  - 3. An electric motor.
  - 4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating motors shall be capable of 80 starts per hour with a 30% motor run time during each start.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
  - 1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
  - Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
  - 3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
  - 4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
  - 5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
  - 8. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
  - 9. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
  - 10. Oil Type: Readily biodegradable that is USDA certified biobased product, ultra low toxicity, readily biodegradable, energy efficient, high performing fluid made from canola oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Especially formulated for operating in environmentally sensitive areas. USDA certified biobased product, 95% bio-based content, per ASTM D6866.

### 2.5 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
  - 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
  - 2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish.
  - 3. Typical door & frame finish: ASTM A 366 steel panels, factory applied powder coat enamel finish.
- B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1<sup>st</sup> landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.
- C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details.

- D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
  - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
  - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
  - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

### 2.6 CAR ENCLOSURE

- A. Car Enclosure:
  - 1. Walls: Cab type TKLP, durable wood core finished on both sides with high pressure plastic laminate.
  - 2. Canopy: Cold-rolled steel with hinged exit.
  - 3. Ceiling: Suspended type, fluorescent lighting with translucent diffuser mounted in a metal frame.
  - 4. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
  - 5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
    - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
    - b. Cab Sills: Extruded aluminum, mill finish.
  - 6. Handrail: Provide 1.5" diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
  - 7. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station will give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

### 2.7 DOOR OPERATION

- A. Door Operation: Provide a direct current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and the door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. Closed-loop, microprocessor controlled motor-driven linear door operator, with adjustable torque limits, also acceptable. AC controlled units with oil checks or other deviations are not acceptable.
  - 1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
  - 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident

hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.

- 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.
- 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer will sound. When the obstruction is removed, the door will begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors will stop and resume closing only after the obstruction has been removed.
- 5. Limited Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.
- 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors will recycle closed then attempt to open six times to try and correct the fault.
- 7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors will recycle open then attempt to close six times to try and correct the fault.
- 8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Devices: Provide a door protection system using 150 or more microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

# 2.8 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Swing return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: Not Required
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Limited Access Operation: Keyswitch and card reader space. (card reader by others)

# 2.9 CONTROL SYSTEMS

- A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Service Panel to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
  - 1. Access to main control board and CPU
  - 2. Main controller diagnostics
  - 3. Main controller fuses
  - 4. Universal Interface Tool (UIT)
  - 5. Remote valve adjustment
  - 6. Electronic motor starter adjustment and diagnostics
  - 7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
  - 8. Operation of auxiliary pump/motor (secondary hydraulic power source)
  - 9. Operation of electrical assisted manual lowering
  - 10. Provide male plug to supply 110VAC into the controller
  - 11. Run/Stop button
- C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- D. Special Operation: Limited Access Operation: A key switch shall be provided to initiate the Limited Access Operation. The activation of this operation shall restrict the operation of the elevator car calls to selected floors on a per-floor, per elevator basis. Travel to the restricted floors shall be allowed after the entry of the required access code via a card reader device supplied by others. The card reader entry shall override the car call restrictions and allow entry of a car call to a restricted floor.
- E. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

### 2.10 HALL STATIONS

- A. Hall Stations, General: Provide buttons with red-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
  - Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
  - 1. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Position Indicator: Not Applicable

- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

#### 2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
- B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.
- C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code.

## PART 3 EXECUTION

- 3.1 EXAMINATION
  - A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and control space, as constructed and verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
  - B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

## 3.2 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
  - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
  - 2. Comply with the National Electrical Code for electrical work required during installation.
- C. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- D. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
- E. Lubricate operating parts of system where recommended by manufacturer.

### 3.3 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required by A17.1 Code and local authorities having jurisdiction. Perform other tests, if any, as required by governing regulations or agencies.
- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

### 3.4 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

## 3.5 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless stall shall be cleaned with soap and water and dried with a non-abrasive surface; shall not be cleaned with bleached-based cleansers.
- A. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
  - a. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

#### 3.6 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

### 3.7 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

### 3.8 ELEVATOR SCHEDULE

- A. Elevator Qty. 1
  - 1. Elevator Model: enduraMRL Above-Ground (2-Stage)
  - 2. Rated Capacity: 2100 lbs.
  - 3. Rated Speed: 80 ft./min.
  - 4. Operation System: TAC32
  - 5. Travel: 14'-8"
  - 6. Landings: 2 total
  - 7. Openings:
    - a. Front: 2
    - b. Rear: 0

- 8. Clear Car Inside: 5' - 8" wide x 4' - 3" deep
- Cab Height: 8'-0" nominal 9.
- Hoistway Entrance Size: 3' 0" wide x 7'-0" high
  Door Type: Single Speed
- Power Characteristics: As indicated on drawings.
   Fixture & Button Style: Signa4 Signal Fixtures
- Special Operations: Limited Access with card readers by others. 14.

END OF SECTION 142400

SECTION 201305 - GEOTHERMAL LOOP SYSTEM

### PART 1 - GENERAL

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Provide a complete Geothermal Heat Exchanger (GLHE) as shown on the drawings, to couple to the Geothermal Heat Pump units specified elsewhere, to provide an ARI 330 Ground Source Closed Loop Heat Pump system.
- 1.3 The entire loop system shall be freeze protected to 15 def. F (20% propylene glycol), measured by volume. All materials used shall comply with all local and state laws, ordinances and codes.
- 1.4 Manufacturers Qualifications: Firms regularly engaged in manufacture of Geothermal Loop Heat Exchanger products and tools of the types, materials and sizes required; whose products have been in satisfactory use in similar service applications for not less than 5 years.

PART 2 - CONTRACTOR QUALIFICATIONS:

- 2.1 The loop installer/contractor shall have a current International Ground Source Heat Pump Association {IGSHPA) certification, having completed an IGSHPA training course in the fundamentals of design, installation, and operation of ground source systems, and having passed the IGSHPA certification examination.
- 2.2 Ground heat exchanger fabricators shall have completed a heat fusion school in which each participant has performed a heat fusion procedure under direct supervision of a IGSHPA Certified Heat Fusion Technician. The Fusion Technician shall be thoroughly familiar with heat fusion procedures, and have had formal training at a heat fusion school under direct supervision of an IGSHPA certified instructor.
- 2.3 Local and state laws, ordinances, and regulations as they pertain to buried pipe systems shall be strictly followed.

PART 3 - SUBMITIALS:

- 3.1 Reference Specification Section REQUIRED SHOP DRAWINGS, ETC. for additional requirements.
- 3.2 Submit the following items before construction activities:
  - Manufacturer's specification sheets and installation instruction for each component of the system, showing manufacturer, pipe or tube weight, pressure rating, fitting type and joint type for each piping system.
  - Manufacturer's data for geothermal vault and components.
  - · Manufacturer's data for the grout mixture. Submit details on grouting procedures,

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

methods and equipment.

- Manufacturer's data sheets for geothermal loop fluid.
- Written flushing, purging, pressure and flow testing plan. Include purge cart cut sheets.

## 3.3 Submit the following items after construction activities:

- Geothermal loop fluid test results.
- Grout testing results for 10% of vertical bores.
- Written results of flushing, purging, pressure and flow testing.
- Schedule dates for warranty period flushing, purging, etc.
- Survey/Record Drawings with dimensions from fixed benchmarks, depths and sizes.
- Written tracer wire test results.
- Submission of the completed items *above* is a condition of acceptance and closeout for the Project.

PART 4 - WARRANTY:

4.1 The entire ground loop system and backfill from a point 5'-0" inside the building shall be warranted for five years from date of substantial completion against any leakage or failure.

PART 5 - PIPING MATERIALS:

- 5.1 Acceptable pipe materials for the underground buried portion of the ground heat exchanger are polyethylene as specified in this Section. Piping shall be listed for closed-loop ground source geothermal application. The pipe and fittings of the buried system shall be warranted by the manufacturer for ground source heat pump service.
- 5.2 ACCEPTABLE MANUFACTURERS: Driscoplex 5300 Climate Guard, Centennial Plastics, Charter Plastics, Flying W Plastics, Lamson Vylon Pipe, PolyPipe, Inc.
- 5.3 Manufacturer shall supply a written warranty of 25 years or greater, specifying material replacement and labor allowance.
- 5.4 All pipe and heat fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D-2513, Sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D- 3035 or D-2447. Fittings shall be manufactured to diameters, wall thicknesses, and respective tolerances as specified in ASTM D-2683 for socket fittings and ASTM F-1055 for electrofusion fittings.
- 5.5 The pipe material shall maintain a 1600 psi hydrostatic design basis at 73.4 degrees F per ASTM D- 2837, and shall be listed in PPI TR4 as a PE3408 piping formulation. The material shall be high density, polyethylene extrusion compound having a cell classification of PE345434C or PE355434C as specified in ASTM D-3350 except this material shall exhibit zero failures (FO) when tested for 192 or more hours under ASTM D-1693, condition C, as required in ASTM D-3350.

- 5.6 Pipe shall be manufactured in accordance with ASTM D-3035 and sized as follows:
  - Pipe sizes 1 ¼" or less: DR 11 AND rated @ 200 psi.
    - Pipe sizes 1 ½" 2": DR 15.5
    - Pipe sizes 3" and larger; DR 17
- 5.7 Sufficient information shall be permanently marked on the length of the pipe as defined by the appropriate ASTM pipe standard. Piping shall also have permanent factory length markings.
- PART 6 PIPE JOINING METHODS:
- 6.1 The only acceptable method for joining buried pipe systems is by a heat fusion process.
- 6.2 Polyethylene pipe shall be butt or socket fused in accordance with pipe manufacturer's procedures.
- 6.3 "U" bends fittings shall be used at bottom of the vertical bores. "U" bend fitting shall be factory built and manufactured by manufacturer of piping materials, no exceptions.
- PART 7 FLUSHING. PURGING. PRESSURE AND FLOW TESTING:
- 7.1 Refer to Specification Section PIPE FILLING, CLEANING, FLUSHING, PURGING AND CHEMICAL TREATMENT for additional information and coordination requirements.
- 7.2 Refer to Specification Section TESTING, ADJUSTING AND BALANCING for additional information and coordination requirements.
- 7.3 Include in the bid an additional, complete, piping network purge at substantial completion and at 3, 6, 9 and 12 months from substantial completion.
- 7.4 Successful flushing and purging is critical and shall be accomplished and documented. Notify Engineer prior to flushing and purging. Submit flushing and purging plan to engineer two (2) months prior to commencing this work.
- 7.5 Vertical loops shall be pressure tested before installation, and all horizontal components of the ground heat exchanger will be flushed, pressure and flow tested prior to backfilling. All fusion joints and loop lengths shall be checked to verify that no leaks have occurred due to fusion joining or shipping damage. Heat exchangers shall be tested hydrostatically at 150% of the pipe design rating or 300% of the system operating pressure (whichever is greater). No leaks shall occur within a 120 minute period.
- 7.6 The type of purging cart/equipment is critical to successful flushing and purging. The purge cart shall be sterilized before each use. The purge cart shall include a pump that minimally develops 350 gpm of flow at 130 feet of head pressure developed. It shall include a large purge return tank, interconnection piping, inlet/outlet pressure gauges, water flow readout display reversing valve and 4" flexible hose connection. Coordinate so that the vault purge ports match purge cart couplings. The first circuit purged after

hose connection shall be purged minimally one hour to remove extra air introduced from the hoses. Once the first circuit is purged, minimally purge other circuits for 30 minutes. Once all well circuits are purged, close all circuit valves and purge piping between vaults and building heat exchanger using building purge ports.

- 7.7 Flow rates shall be compared to calculated values to assure that there is no blockage or kinking of any pipe. Submit written verification of compliance.
- 7.8 A minimum velocity of 3 ft/sec in each piping section must be maintained until all air is removed. The system shall also be forward and reversed to remove all debris. Purging of one wellfield row shall be witnessed by the Engineer, Owner, Mechanical Contractor, General Contractor and the Test and Balance Contractor. The Test and Balance Contractor shall confirm the minimum velocities are obtained during the purging process and shall also measure supply and return pressures. The Contractor shall provide P/T plugs as required by the Test and Balance Contractor. The Contractor shall provide all means and methods necessary to insure minimum velocities are obtained. After one test is confirmed, the other wellfield rows shall be tested utilizing the same procedure. The Test and Balance Contractor shall confirm all minimum circuit. flow rates are obtained for all wellfield piping.
- 7.9 Final purging of air from the entire building loop and wellfield loop shall be performed by the wellfield purging contractor so that air in the building will not be transferred with the wellfield. Coordinate with the Mechanical Contractor.

### PART 8 - HORIZONTAL PIPING SYSTEMS:

- 8.1 Refer to Section EXCAVATION, BACKFILLING AND TRENCHING AND GRADING for additional requirements.
- 8.2 Sharp bending of pipe around trench corners shall be prevented by using a shovel to round corners, or by installing an appropriate elbow fitting. Manufacturer's procedures shall be followed.
- 8.3 Backfilling procedure will include prevention of any sharp-edged rocks from coming into contact with the pipe by removal of the rocks before backfilling, backfill with #8 rock. Provide a minimum of 6" cover over pipe with back filled material. Clods resulting from use of a backhoe shall be broken so as not to form air pockets around the pipe which will reduce heat conduction between the earth and the pipe. The flow of backfill soil must be controlled to prevent bridging and the formation of air pockets. Several slow passes with an angled backfill blade are required. Flooding is required to assure removal or air pockets. Minimum bury depth of piping shall be 36" to top of pipe.
- 8.4 Horizontal return bends must be backfilled by hand to properly support the pipes and prevent kinking.
- 8.5 Install continuous tracer wires and warning tape on each wellfield circuit in and out of the geothermal vault and the building. Provide an additional 36" of coiled tracer wire on each end and attach in vault at each circuit. Provide an additional 36' of coiled tracer wire on each end and attach in building at each circuit riser. Perform tracer wire testing for all

tracer wires in conjunction with the Owner/Engineer - this is a condition of acceptance and closeout.

- 8.6 Install continuous tracer wires and warning tape on each wellfield circuit in and out of the building. Provide an additional 36" of coiled tracer wire on each end and attach in building at each circuit riser. Perform tracer wire testing for all tracer wires in conjunction with the Owner/Engineer this is a condition of acceptance and closeout.
- 8.7 Provide GPS coordinated mapping of all vertical loops.

PART 9 - BORE HOLE AND GROUTING:

- 9.1 The Contractor shall accept the site as-is and is responsible for any and all required steel casings. If an area of voids is encountered, the Contractor shall either fill or re-drill wells in an approved area and extend piping to them. No night drilling will be allowed.
- 9.2 The Contractor shall bore wells of a sufficient diameter to allow installation of the piping and U-bend and a 1-1/4" (minimum) HDPE tremie pipe for grout installation, but shall be no less than  $6"-6 \frac{1}{2}"$ .
- 9.3 Bore holes shall be grouted to ensure good heat transfer. Local and state laws and regulations for grouting and backfilling shall be followed. See IGSHPA Grouting Procedures Manual for detailed grouting procedures.
- 9.4 Vertical bores shall be drilled to sufficient depths to ensure that the entire length of U-tube is inserted. This may require the bore to be drilled several feet deeper than the U-tube length.
- 9.5 All U-tube joints shall be visually inspected for integrity as specified by the pipe manufacturer (alignment of joints, proper bead roll-back) before insertion into the bore hole.
- 9.6 The bore hole annulus shall be completely grouted to ensure there are no air voids and to ensure there is consistent contact between the vertical piping and the bore hole formation. This will require the bore annulus to be filled with grout from the bottom to the top with a "tremie" tube.
- 9.7 The entire bore shall be grouted with a thermally enhanced grout mixture with a thermal conductivity of 1.00 Btu/hr-ft-°F. Grout shall be GeoPro Thermal Grout Lite 100 bentonite mixture or approved equal. Mixture shall be field mixed in strict accordance with manufacturer's recommendations. Grout mixture shall be mechanically pumped with a positive displacement pump into bore hole from bottom to top utilizing a tremie tube.
- 9.8 Through the course of the project, sample grout specimens shall be randomly (chosen by Construction Manager) taken of the mixed grouting material by this Contractor for 10% of the vertical bores. An analysis shall be performed by the grout manufacturer to verify proper thermal performance and grout mixture. This Contractor shall submit these reports to the Owner, Architect and Engineer to verify compliance with the installation specifications.

PART 10 - GEOTHERMAL VAULT:

- 10.1 The vault shall pre-cast concrete or manufactured high density polyurethane and tested prior to shipping to jobsite. Refer to the vault detail on the drawings for further construction requirements and details.
- 10.2 For concrete vault walls and top shall be 6" thick with  $\frac{1}{2}$ " rebar 12" on center in both directions. The bottom shall be 4" thick with  $\frac{1}{2}$ " rebar 12" on center in both directions.
- 10.3 For concrete vault the exterior of the vault shall be sealed with a water proof membrane or coating. Reference Specification Section "COLD FLUID-APPLIED WATERPROOFING" for other requirements.
- 10.4 Provide a stainless steel or aluminum access hatch USF fabrication, APD or approved equal. The hatch shall be mounted in an extension collar. Hatch shall be set 3" above finish grade and dirt mounded to prevent run-off from pooling at the cover.
- 10.5 Provide a ladder for access. Refer to the detail on the drawings for mounting requirements.
- 10.6 INTERNAL PIPING: Shall be as previously specified. The vault piping shall be constructed in an offset, over and under, model for supply and return lines. All joints shall be heat fused. The entire piping system shall be tested using 150 psi air. The main supply and return pipe shall be shipped with cap butt welded to pipe. All pipe penetrating the vault walls shall be DR 11 and grouted to be water tight.
- 10.7 P/T PLUGS: Shall be constructed of solid brass and have a dual seal core of Nordel, with a 350°F rating for water. Plugs shall be rated zero leakage for vacuum to 1000 psig and shall be capable of receiving a pressure or temperature probe. Install at the inlet and outlet of each circuit.
- 10.8 BUTTERFLY VALVE: Shall be constructed of a cast iron body, 416 stainless steel stem with a lever shut off system. Refer to Section VALVES for all valve requirements. Install for each circuit supply and return.
- 10.9 90° ELBOWS: Shall be molded out of high density polyethylene resins in accordance with the requirements of ASTM 3261.
- 10.10 BRANCH AND SERVICE SADDLES: Shall be molded out of high density polyethylene resins in accordance with the requirements of ASTM 3261.
- 10.11 INSTALLATION: The vault shall be lowered into a pit of sufficient depth with a 6" bed of #57 gravel. Once the vault is in place, the vault shall be anchored and sufficient back-fill put in place.
- 10.12 Coordinate power/ lighting requirements with Electrical Contractor.

PART 11 - ADDITIONAL INSTALLATION REQUIREMENTS:

11.1 Underground land survey of the entire geothermal wellfield system per GENERAL PROVISIONS
 MECHANICAL. This shall include all horizontal piping, vaults, vertical bore locations and dimension from above grade fixed benchmarks. The underground survey shall be included in the closeout documentation.

- 11.2 DUST CONTROL: The Contractor shall be responsible for and shall provide dust control. Dust shall not be allowed to leave the construction site boundaries, and furthermore, shall not be allowed to enter the building or accumulate on the building exterior. When needed to meet these requirements, the Contractor shall provide and operate a mechanical dust collection system to control dust at the source. Mechanical dust collector which separates dust from the airstream. Dust shall be collected into sealed containers for disposal by the Contractor. Water spraying may be used but shall not be considered a substitute for mechanical dust collection at the source dust the source when required.
- 11.3 SURFACE WATER / MUD / SLURRY CONTROL: The Contractor shall be responsible for and shall provide control of all ground flowing fluids resulting from drilling operations. The Contractor shall erect silt fences or other structures as required to contain drill cuttings, mud, slurry, etc. within the construction site boundaries. In the event this requirement is not met, the Contractor shall provide all remediation measures as required by all authorities having jurisdiction over such events.

END OF SECTION 201305

# SECTION 201310 - PIPE FILLING, CLEANING. FLUSHING. PURGING AND CHEMICAL

## TREATMENT

## PART 1 - GENERAL

- 1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.
- 1.2 Review the Specification Section REQUIRED SHOP DRAWINGS, ETC., and provide all documentations called for therein.
- 1.3 Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall insure a complete, 100% functional, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected.
- 1.4 Maintain a water treatment program for the closed loop piping systems. It is the Contractor's responsibility to contact the engineer 2 weeks in advance to any treatments performed on the systems. It is the Engineer's discretion whether or not this process should be monitored after notification.
- 1.5 A pre-installation meeting shall be held with the Owner, Architect, Engineer, General Contractor, Mechanical Contractor, Pipe Fitter Foreman, Geothermal Contractor and Chemical Treatment Contractor to discuss goals and expectations for cleaning, flushing, purging and chemical treatment.
- 1.6 Chemicals, equipment, testing services, and chemical application shall be supplied by a single water treatment company for undivided responsibility. The water treatment company shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years. The water treatment company shall have regional water analysis laboratories, service department, and full time representatives located within the area of the job site orfacility.
- 1.7 Prior to any construction, the Contractor shall sample the existing closed loop chemicals and provide chemical treatment water quality analysis. Provide levels for all items noted in paragraph "Water Quality Minimum Performance Requirements for Closed Loops". Provide a report to the Engineer.
- 1.8 Be advised the existing loop contains an anti-freeze mixture. Prior to any construction, the Contractor shall sample the existing closed loop and provide anti-freeze mixture data.
- 1.9 Furnish initial supply of the closed loop chemicals for each system. This contractor shall

retest the systems after 3, 6, 9 and 12 months upon substantial completion to verify the proper dosage is in each system. Provide all closed loop chemicals and anti-freeze for the first year. The Contractor shall determine the appropriate chemical volumes for each system. Each system's water shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition, including anti-freeze. Provide any laboratory and technical assistance required to achieve a successful program.

- 1.10 As a condition of acceptance and project closeout, a summary of water quality and treatment shall be provided in writing to the Owner and/or Engineer after the water treatment services have been successfully completed. The closeout documentation shall include dates for warranty testing.
- 1.11 Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- 1.12 WATER QUALITY MINIMUM PERFORMANCE REQUIREMENTS FOR CLOSED LOOPS:
  - Closed hydronic systems shall maintain a pH value within 9 10.5 pH for iron and copper piping loops.
  - Total Anaerobic Plate Count Maintain a maximum value of 100 organisms/ml.
  - Nitrate Reducers (Denitrifying Bacteria) Maintain below a maximum value of 10,000 organisms/ml.
  - Sulfate Reducers Maintain below a maximum value of 200 organisms/ml.
  - Iron Bacteria Maintain below a maximum value of 100 organisms/ml.
  - Slime Bacteria Maintain below a maximum value of 1,000 organisms/ml.

PART 2 - CLEANING AND FLUSHING OF HYDRONIC PIPING:

- 2.1 This project consists of the following Hydronic Piping Loops:
  - Geothermal Heat Pump Water
- 2.2 There are several precautions which must be observed during piping installation. This contractor is advised to read all of the manufacturer's instructions prior to commencing the installation. This cleaning and flushing of the systems must be accomplished. Refer to Specification Section GEOTHERMAL LOOP SYSTEM for geothermal system requirements.
- 2.3 All water circulating systems for the project shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil and any and all other material foreign to the water. During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined and all dirt removed.
- 2.4 After the piping is complete:

- 2.4.1 The contractor shall close all JSHP isolation valves and open all by-pass valves.
- 2.4.2 The Contractor shall first fill the piping loops and all runouts with clear water. The loop water shall be circulated at a minimum of 3 fps for one hour with make-up water open and drain open to accomplish initial flushing of the system. Flushing shall be repeated in opposite direction for one hour. Repeat steps for buildings loop, well field, then entire system. Flushing filter shall be a minimum of 50 million. Filter shall be visually documented for cleanliness.
- 2.4.3 After initial flushing, all strainers shall be cleaned and the individual terminal devices and coils shall be connected permanently to the supply and return runouts conditions and then add trisodium phosphate in an aqueous solution to the system at the proportion of one pound per fifty gallons of water in the system.
- 2.4.4 After the system is filled with this solution, the loop shall be allowed to circulate for 24 hours.
- 2.4.5 Test and balance contractor shall verify flows/pressures are met during flushing of entire system.
- 2.4.6 The Chemical Treatment Contractor shall be given notice by the Contractor of scheduling this cleaning and, if the Engineer's representative deems it necessary, the operation shall be repeated.
- 2.4.7 After the system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side.
- 2.4.8 If the system is found to be still on the acid side, the cleaning by use of Trisodium Phosphate shall be repeated.
- 2.4.9 After the cleaning including all strainers and flushing is complete, and approved by Engineer, the Contractor shall provide the proper water treatment for the system.

# PART 3 - CLOSED LOOP CHEMICAL TREATMENT:

- 3.1 After the system is complete it shall be thoroughly cleaned before placing in operation to rid the system of dirt, biological contamination, piping compound, loose mill scale, *oi'1* and any and all other material foreign to the water as previously specified.
- 3.2 Before chemical cleaning and sterilization of the entire system, the field and hydronic loop and mains shall be individually flushed and purged until free of dirt, debris, and air. During the flushing/purging and chemical cleaning processes the supply and return run-outs shall be temporarily placed in bypass operation. See SYSTEM FILLING & PURGING PLAN for additional information.
- 3.3 After chemical cleaning, the entire system shall be sterilized with a biocide added at

recommended dosage to effectively kill any present microorganisms. Add glutaraldehyde to achieve 60 - 200 ppm of active ingredient or isothiazoline to achieve 10 - 13 ppm active. Do not flush biocide from system. Corrosion inhibitors shall be installed in closed loop systems containing metal piping, fittings, accessories, etc.

3.4 A bacteria analysis shall be performed to ascertain biological cleanliness of system. If bacteria counts are above set parameters then sterilization process shall be repeated until bacteria counts are at or

below acceptable levels. Microbiological limits are listed under "Water Quality Minimum Performance Requirements" elsewhere in this Specification Section.

3.5 Within 48 hours of the completion of the sterilization and confirmation that bio-levels are within the specified parameters, implement a water treatment program to passivate all metal surfaces.

END OF SECTION 201310
SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Sleeves.
  - 3. Escutcheons.
  - 4. Grout.
  - 5. Fire-suppression equipment and piping demolition.
  - 6. Equipment installation requirements common to equipment sections.
  - 7. Supports and anchorages.

### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

### 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. 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 08 Section "Access Doors and Frames."

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

## 2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

### 2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chromeplated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

### 2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

### PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

- 1. New Piping:
  - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
  - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsumboard partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

#### 3.4 GROUTING

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout around anchors.
- F. Cure placed grout.

### END OF SECTION 210500

### SECTION 210513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

## 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

- 2.1 GENERAL MOTOR REQUIREMENTS
  - A. Comply with NEMA MG 1 unless otherwise indicated.
  - B. Comply with IEEE 841 for severe-duty motors.

### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

### 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

### 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 210513

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Restrained elastomeric isolation mounts.
    - 2. Restraining braces.

### 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

### 1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: C.
  - 2. Assigned Seismic Use Group or Building Risk Category as Defined in the IBC: III.
  - 3. Seismic Design Category: D.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
  - 2. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

## 1.6 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

# PART 2 - PRODUCTS

## 2.1 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 3. Hilti, Inc.
  - 4. Kinetics Noise Control.
  - 5. Mason Industries.
  - 6. TOLCO Incorporated; a brand of NIBCO INC.
  - 7. Unistrut; Tyco International, Ltd.

- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

## 2.2 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel or powder coat for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

## 3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127 and NFPA 13.
  - 2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  - 3. Brace a change of direction longer than 12 feet (3.7 m).
- B. Install cables so they do not bend across edges of adjacent equipment or building structure.
- C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- E. Drilled-in Anchors:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

END OF SECTION 210548

# SECTION 211313 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
  - 1. Automatic wet-type, sprinkler systems.
- B. Related Sections include the following:
  - 1. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.

#### 1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig (1200 kPa).
- D. PE: Polyethylene plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig (1200 kPa).
- B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - 2. Sprinkler Occupancy Hazard Classifications:
    - a. Refer to Drawings.
  - 3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (6.3 mL/s over 139-sq. m) area.

- b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
- 4. Maximum Protection Area per Sprinkler: Per UL listing.
- 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
  - a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
  - b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
- C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
  - 2. Pipe hangers and supports, including seismic restraints.
  - 3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
  - 4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
  - 5. Alarm devices, including electrical data.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Fire-hydrant flow test report.
- D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

- a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."

## 1.7 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
  - 1. Cast-Iron Threaded Flanges: ASME B16.1.
  - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
  - 3. Gray-Iron Threaded Fittings: ASME B16.4.
  - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
  - 5. Steel Threaded Couplings: ASTM A 865.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

- 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
  - a. Manufacturers:
    - 1) Anvil International, Inc.
    - 2) Victaulic Co. of America.
- C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, square-cut- or roll-grooved ends.
  - 1. Grooved-Joint Piping Systems:
    - a. Manufacturers:
      - 1) Anvil International, Inc.
      - 2) Central Sprinkler Corp.
      - 3) Victaulic Co. of America.
    - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
    - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
- D. Threaded-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe; with factory- or field-threaded ends.
  - 1. Cast-Iron Threaded Flanges: ASME B16.1.
  - 2. Malleable-Iron Threaded Fittings: ASME B16.3.
  - 3. Gray-Iron Threaded Fittings: ASME B16.4.
  - 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
  - 5. Steel Threaded Couplings: ASTM A 865.
- E. Plain-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and ASME B36.10M, Schedule 30 wrought-steel pipe.
  - 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting.
    - a. Manufacturers:
      - 1) Anvil International, Inc.
      - 2) Victaulic Co. of America.
- F. Grooved-End, Schedule 30 Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and equal to or greater than Schedule 30; or ASTM A 795 and

ASME B36.10M, Schedule 30 wrought-steel pipe; with factory- or field-formed, roll-grooved ends.

- 1. Grooved-Joint Piping Systems:
  - a. Manufacturers:
    - 1) Anvil International, Inc.
    - 2) Central Sprinkler Corp.
    - 3) Victaulic Co. of America.
  - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
  - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

### 2.3 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Hart Industries International, Inc.
    - e. Watts Industries, Inc.; Water Products Div.
    - f. Zurn Industries, Inc.; Wilkins Div.
- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig (1200-kPa) minimum working-pressure rating as required for piping system.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products and Systems, Inc.
    - b. Calpico, Inc.

- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig (2070-kPa) working-pressure rating at 225 deg F (107 deg C).
  - 1. Manufacturers:
    - a. Perfection Corporation.
    - b. Precision Plumbing Products, Inc.
    - c. Victaulic Co. of America.

## 2.4 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig (1725-kPa) minimum working-pressure rating if fittings are components of high-pressure piping system.
- B. Outlet Specialty Fittings:
  - 1. Manufacturers:
    - a. Anvil International, Inc.
    - b. Central Sprinkler Corp.
    - c. Ductilic, Inc.
    - d. JDH Pacific, Inc.
    - e. National Fittings, Inc.
    - f. Shurjoint Piping Products, Inc.
    - g. Southwestern Pipe, Inc.
    - h. Star Pipe Products; Star Fittings Div.
    - i. Victaulic Co. of America.
    - j. Ward Manufacturing.
  - 2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.
  - 3. Snap-On and Strapless Outlet Fittings: UL 213, ductile-iron housing or casting with gasket and threaded outlet.
- C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
  - 1. Manufacturers:

- a. Central Sprinkler Corp.
- b. Fire-End and Croker Corp.
- c. Viking Corp.
- d. Victaulic Co. of America.
- D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
  - 1. Manufacturers:
    - a. Elkhart Brass Mfg. Co., Inc.
    - b. Fire-End and Croker Corp.
    - c. Potter-Roemer; Fire-Protection Div.
- E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
  - 1. Manufacturers:
    - a. AGF Manufacturing Co.
    - b. Central Sprinkler Corp.
    - c. G/J Innovations, Inc.
    - d. Triple R Specialty of Ajax, Inc.
- F. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
  - 1. Manufacturers:
    - a. CECA, LLC.
    - b. Merit.
- G. Flexible Sprinkler Hose Fittings: UL 1474 flexible hose for connection to sprinkler and with bracket for connection to ceiling grid. Minimum pressure rating of 115 psig.
  - 1. Manufacturer:
    - a. Victaulic Co. of America or approved equal.

## 2.5 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be UL listed or FMG approved, with 175-psig (1200 kPa) minimum pressure rating. Valves shall have 250-psig (1725-kPa) minimum pressure rating if valves are components of high-pressure piping system.
- B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
  - 1. NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
  - 2. NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductileiron body with grooved ends.
  - 3. NPS 3 (DN 80): Ductile-iron body with grooved ends.
  - 4. Manufacturers:
    - a. NIBCO.
    - b. Victaulic Co. of America.

- C. Butterfly Valves: UL 1091.
  - 1. NPS 2 (DN 50) and Smaller: Bronze body with threaded ends.
    - a. Manufacturers:
      - 1) Global Safety Products, Inc.
      - 2) Milwaukee Valve Company.
  - 2. NPS 2-1/2 (DN 65) and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
    - a. Manufacturers:
      - 1) Central Sprinkler Corp.
      - 2) Global Safety Products, Inc.
      - 3) McWane, Inc.; Kennedy Valve Div.
      - 4) Mueller Company.
      - 5) NIBCO.
      - 6) Pratt, Henry Company.
      - 7) Victaulic Co. of America.
- D. Indicating Valves: UL 0191, with integral indicating device and ends matching connecting piping.
  - 1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
  - 2. NPS 2 (DN 50) and smaller: Ball or butterfly valve with bronze body and threaded ends.
    - a. Manufacturers:
      - 1) Milwaukee Valve Company.
      - 2) NIBCO.
      - 3) Victaulic Co. of America.
  - 3. NPS 2-1/2 (DN 65) and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.
    - a. Manufacturers:
      - 1) Central Sprinkler Corp.
      - 2) Grinnell Fire Protection.
      - 3) McWane, Inc.; Kennedy Valve Div.
      - 4) Milwaukee Valve Co.
      - 5) MIBCO.
      - 6) Victaulic Co. of America

### 2.6 SPECIALTY VALVES

- A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig (1200-kPa) minimum pressure rating.
  - 1. Manufacturers:
    - a. Central Sprinkler Corp.

- b. Firematic Sprinkler Devices, Inc.
- c. Globe Fire Sprinkler Corporation
- d. Grinnell Fire Protection.
- e. Viking.

# 2.7 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 (DN 50) and Smaller: MSS SP-110, 2-piece copper-alloy body with chromeplated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

### 2.8 SPRINKLERS

- A. Sprinklers shall be UL listed or FMG approved, with 175-psig (1200-kPa) minimum pressure rating.
- B. Manufacturers:
  - 1. Central Sprinkler Corp.
  - 2. Grinnell Fire Protection.
  - 3. Reliable Automatic Sprinkler Co., Inc.
  - 4. Victaulic Co. of America.
  - 5. Viking Corp.
- C. Automatic Sprinklers: With heat-responsive element complying with the following:
  - 1. UL 199, for nonresidential applications.
  - 2. UL 1767, for early-suppression, fast-response applications.
- D. Sprinkler Types and Categories: Nominal 1/2-inch (12.7-mm) orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
  - 1. Open Sprinklers: UL 199, without heat-responsive element.
    - a. Orifice: 1/2 inch (12.7 mm), with discharge coefficient K between 5.3 and 5.8.
    - b. Orifice: 17/32 inch (13.5 mm), with discharge coefficient K between 7.4 and 8.2.
- E. Sprinkler types, features, and options as follows:
  - 1. Concealed ceiling sprinklers, including cover plate. (Color to match ceiling. Provide physical color sample to Architect).
  - 2. Extended-coverage sprinklers.
  - 3. Pendent sprinklers.
  - 4. Quick-response sprinklers.
  - 5. Recessed sprinklers, including escutcheon.
  - 6. Sidewall sprinklers.
  - 7. Upright sprinklers.
- F. Sprinkler Finishes: Chrome plated, bronze, and painted. (Color to match ceiling. Provide physical color sample to Architect).

- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat, Chrome-plated steel, 2 piece, with 1-inch (25-mm) vertical adjustment.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.
- B. Report test results promptly and in writing.

### 3.2 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 PIPING APPLICATIONS, GENERAL

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

### 3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig (1200-kPa) Maximum Working Pressure:
  - 1. Sprinkler-Piping Fitting Option: Specialty sprinkler fittings, NPS 2 (DN 50) and smaller, including mechanical-T and -cross fittings, may be used downstream from sprinkler zone valves.

- 2. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black, standard-weight steel pipe; castor malleable-iron threaded fittings; and threaded joints.
- 3. NPS 1-1/2 (DN 40) and Smaller: Threaded-end, black, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- 4. NPS 2 (DN 50): Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- 5. NPS 2 (DN 50): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 6. NPS 2 (DN 50): Threaded-end, black, Schedule 30 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
- 7. NPS 2 (DN 50): Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 8. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 9. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 10. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 11. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, black, Schedule 30 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 12. NPS 4 to NPS 6 (DN 100 to DN 150): Grooved-end, Schedule 10 steel pipe; groovedend fittings; grooved-end-pipe couplings; and grooved joints.

## 3.5 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.
    - a. Shutoff Duty: Use ball or butterfly valves.
  - 2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.
    - a. Shutoff Duty: Use ball or butterfly valves.
    - b. Throttling Duty: Use ball or globe valves.

## 3.6 JOINT CONSTRUCTION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping joint construction.
- B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.
- C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

- 1. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
- D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
  - 1. NPS 2 (DN 50) and Smaller: Use dielectric unions, couplings, or nipples.
  - 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
  - 3. NPS 5 (DN 125) and Larger: Use dielectric flange insulation kits.

### 3.7 PIPING INSTALLATION

- A. Refer to Division 21 Section "Common Work Results for Fire Suppression" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install drain valves on standpipes.
- I. Install alarm devices in piping systems.
- J. Hangers and Supports: Comply with NFPA 13 for hanger materials.
  - 1. Install standpipe system piping according to NFPA 14.
  - 2. Install sprinkler system piping according to NFPA 13.
- K. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.
- L. Fill wet-pipe sprinkler system piping with water.

### 3.8 VALVE INSTALLATION

- A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

### 3.9 SPRINKLER APPLICATIONS

- A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
  - 1. Rooms without Ceilings: Upright sprinklers. Refer to drawings for additional information.
  - 2. Rooms with Suspended Ceilings: Recessed sprinklers except in decorative ceiling as noted.
  - 3. Wall Mounting: Sidewall sprinklers.
  - 4. Sprinkler Finishes:
    - a. Upright and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
    - b. Concealed Sprinklers: Rough brass, with cover plate to match ceiling. Provide physical color sample to Architect for selection.
    - c. Recessed sprinklers: Chrome plated.

### 3.10 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

### 3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect alarm devices to fire alarm.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.12 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

## 3.13 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Energize circuits to electrical equipment and devices.
  - 4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 5. Coordinate with fire alarm tests. Operate as required.
- B. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- 3.14 CLEANING AND PROTECTION
  - A. Clean dirt and debris from sprinklers.
  - B. Remove and replace sprinklers with paint other than factory finish.
  - C. Protect sprinklers from damage until Substantial Completion.
- 3.15 DEMONSTRATION
  - A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 211000

# SECTION 211316 - DRY-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinkler specialty pipe fittings.
  - 4. Sprinklers.
  - 5. Alarm devices.
  - 6. Manual control stations.
  - 7. Control panels.
  - 8. Pressure gages.

#### 1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For dry-pipe sprinkler systems.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and professional engineer.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- C. Fire-hydrant flow test report.
- D. 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." F. Field quality-control reports.

# 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

# 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

# 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

# PART 2 - PRODUCTS

- 2.1 SYSTEM DESCRIPTIONS
  - A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.
  - B. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Fire-detection system, located in same area as sprinklers, actuates

tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from opened sprinklers.

- C. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.
- D. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air. Actuation of a fire-detection system, located in same area as sprinklers, opens deluge valve, permitting water to flow into sprinkler piping. A closed solenoid valve in the sprinkler piping is opened by another fire-detection device; water will then discharge from opened sprinklers.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.

### 2.3 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E. Pipe ends may be factory or field formed to match joining method.
- B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME B16.1, Class 125.
- G. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

- J. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following or approved equal prior to bid:
    - a. Anvil International; Mueller Water Products, Inc.
    - b. Tyco Fire Suppression & Building Products.
    - c. Victaulic Company.
  - 3. Pressure Rating: 175-psig (1200-kPa) minimum.
  - 4. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
  - 5. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

## 2.5 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  - 1. Standard-Pressure Piping Specialty Valves: 175-psig (1200-kPa) minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Deluge Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. CLA-VAL Automatic Control Valves.
    - b. Globe Fire Sprinkler Corporation.
    - c. Reliable Automatic Sprinkler Co., Inc. (The).
    - d. Tyco Fire Suppression & Building Products.
    - e. Victaulic Company.
    - f. Viking Corporation.
  - 3. Standard: UL 260.

- 4. Design: Hydraulically operated, differential-pressure type.
- 5. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gages, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.
- 6. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.
- 7. Air-Pressure Maintenance Device:
- 8. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 9. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
  - a. Globe Fire Sprinkler Corporation.
  - b. Reliable Automatic Sprinkler Co., Inc. (The).
  - c. Tyco Fire Suppression & Building Products.
  - d. Victaulic Company.
  - e. Viking Corporation.
  - f. Standard: UL 260.
  - g. Type: Automatic device to maintain minimum air pressure in piping.
  - h. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range, and 175-psig (1200-kPa), 300-psig (2070-kPa) outlet pressure.
- 10. Air Compressor:
- 11. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 12. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
  - a. Gast Manufacturing Inc.
  - b. General Air Products,
  - c. Viking Corporation.
- 13. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- 14. Motor Horsepower: Fractional.
- 15. Power: 120-V ac, 60 Hz, single phase.
- 16. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a gualified testing agency, and marked for intended location and application
- H. Automatic (Ball Drip) Drain Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Reliable Automatic Sprinkler Co., Inc. (The).
  - b. Tyco Fire Suppression & Building Products.
- 3. Standard: UL 1726.
- 4. Pressure Rating: 175-psig (1200-kPa) minimum.
- 5. Type: Automatic draining, ball check.
- 6. Size: NPS 3/4 (DN 20).
- 7. End Connections: Threaded.

## 2.6 SPRINKLER PIPING SPECIALTIES

- A. General Requirements for Dry-Pipe System Fittings: UL listed for drypipe service.
- B. Branch Outlet Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. Anvil International.
    - b. National Fittings, Inc.
    - c. Shurjoint Piping Products.
    - d. Tyco Fire Suppression & Building Products.
    - e. Victaulic Company.
  - 3. Standard: UL 213.
  - 4. Pressure Rating: 175-psig (1200-kPa) minimum.
  - 5. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  - 6. Type: Mechanical-tee and -cross fittings.
  - 7. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  - 8. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  - 9. Branch Outlets: Grooved, plain-end pipe, or threaded.
- C. Flow Detection and Test Assemblies:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.

- a. AGF Manufacturing Inc.
- b. Reliable Automatic Sprinkler Co., Inc. (The).
- c. Tyco Fire Suppression & Building Products.
- d. Victaulic Company.
- 3. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- 4. Pressure Rating: 175-psig (1200-kPa) minimum.
- 5. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
- 6. Size: Same as connected piping.
- 7. Inlet and Outlet: Threaded.
- D. Branch Line Testers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. Elkhart Brass Mfg. Company, Inc.
    - b. Fire-End & Croker Corporation.
    - c. Potter Roemer LLC.
  - 3. Standard: UL 199.
  - 4. Pressure Rating: 175-psig (1200-kPa) minimum.
  - 5. Body Material: Brass.
  - 6. Size: Same as connected piping.
  - 7. Inlet: Threaded.
  - 8. Drain Outlet: Threaded and capped.
  - 9. Branch Outlet: Threaded, for sprinkler.
- E. Sprinkler Inspector's Test Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. AGF Manufacturing Inc.
    - b. Tyco Fire Suppression & Building Products.
    - c. Victaulic Company.
    - d. Viking Corporation.
  - 3. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  - 4. Pressure Rating: 175-psig (1200-kPa) minimum.
  - 5. Body Material: Cast- or ductile-iron housing with sight glass.
  - 6. Size: Same as connected piping.
  - 7. Inlet and Outlet: Threaded.

- F. Flexible Sprinkler Hose Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. FlexHead Industries, Inc.
    - b. Gateway Tubing, Inc.
  - 3. Standard: UL 1474.
  - 4. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  - 5. Pressure Rating: 175-psig (1200-kPa) minimum.
  - 6. Size: Same as connected piping, for sprinkler.

### 2.7 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
  - 1. Globe Fire Sprinkler Corporation.
  - 2. Reliable Automatic Sprinkler Co., Inc. (The).
  - 3. Tyco Fire Suppression & Building Products.
  - 4. Victaulic Company.
  - 5. Viking Corporation.
- C. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- D. Pressure Rating for Residential Sprinklers: 175-psig (1200-kPa) maximum.
- E. Pressure Rating for Automatic Sprinklers: 175-psig (1200-kPa) minimum.
- F. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig (1725-kPa) minimum.
- G. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Nonresidential Applications: UL 199.
  - 2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- H. Sprinkler Finishes: Chrome plated.

- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat. K. Sprinkler Guards:

## 2.8 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. Fire-Lite Alarms, Inc.; a Honeywell company.
    - b. Notifier; a Honeywell company.
    - c. Potter Electric Signal Company, LLC.
  - 3. Standard: UL 464.
  - 4. Type: Vibrating, metal alarm bell.
  - 5. Size: 8-inch (200-mm) minimum diameter.
  - 6. Finish: Red-enamel factory finish, suitable for outdoor use.
  - 7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Pressure Switches:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
    - a. Potter Electric Signal Company, LLC.
    - b. System Sensor; a Honeywell company.
    - c. Tyco Fire Suppression & Building Products.
    - d. Viking Corporation.
  - 3. Standard: UL 346.
  - 4. Type: Electrically supervised water-flow switch with retard feature.
  - 5. Components: Single-pole, double-throw switch with normally closed contacts.
  - 6. Design Operation: Rising pressure signals water flow.
- D. Valve Supervisory Switches:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following or approved equal prior to bid.
  - a. Fire-Lite Alarms, Inc.; a Honeywell company.
  - b. Kennedy Valve; a division of McWane, Inc.
  - c. Potter Electric Signal Company, LLC.
  - d. System Sensor; a Honeywell company.
- 3. Standard: UL 346.
- 4. Type: Electrically supervised.
- 5. Components: Single-pole, double-throw switch with normally closed contacts.
- 6. Design: Signals that controlled valve is in other than fully open position.
- 7. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

# 2.9 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
  - 1. AGF Manufacturing Inc.
  - 2. AMETEK, Inc.; U.S. Gauge Division.
  - 3. Ashcroft, Inc.
  - 4. Brecco Distribution Corporation.
  - 5. WIKA Instrument Corporation.
- D. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.
- E. Pressure Gage Range: 0 to 300 psig (0 to 2070 kPa).
- F. Label: Include "WATER" or "AIR/WATER" label on dial face.
- G. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

# PART 3 - EXECUTION

# 3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article. B. Report test results promptly and in writing.

# 3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to fire-service piping to building. Comply with requirements in Section 211313 "Wet Pipe Sprinkler Systems" for exterior piping.

### 3.3 PIPING INSTALLATION

Α.

Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

- 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.
- J. Connect air compressor to the following piping and wiring:
  - 1. Pressure gages and controls.
  - 2. Electrical power system.
  - 3. Fire-alarm devices, including low-pressure alarm. M. Install alarm devices in piping

systems.

- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with softmetal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- M. P. Drain dry-pipe sprinkler piping.
- N. Pressurize and check dry-pipe sprinkler system piping and air compressors.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

# 3.5 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and groovedend fittings according to AWWA C606 for steel-pipe joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.6 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources. D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install deluge valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
    - a. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig (95- to 410-kPa) adjustable range; and 175psig (1200-kPa) maximum inlet pressure.

### 3.7 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### 3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

# 3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

#### DRY-PIPE SPRINKLER SYSTEMS

- 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
- 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
- 4. Energize circuits to electrical equipment and devices.
- 5. Start and run air compressors.
- 6. Coordinate with fire-alarm tests. Operate as required. 7. Coordinate with fire-pump tests. Operate as required.
- 8. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

# 3.11 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.
- 3.12 PIPING SCHEDULE
  - A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded joints.
  - B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
  - C. Standard-pressure, dry-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
    - 1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
- 3.13 SPRINKLER SCHEDULE
  - A. Use sprinkler types in subparagraphs below for the following applications:
    - 1. Rooms without Ceilings: Upright sprinklers.
    - 2. Rooms with Suspended Ceilings: Dry pendent, recessed, flush, and concealed sprinklers as indicated.

END OF SECTION 211316

# SECTION 213113 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

# 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. In-line fire pumps.
  - 2. Fire-pump accessories and specialties.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Product Certificates: For each type of fire pump, from manufacturer.
- C. Source quality-control reports.
- D. Field quality-control reports.

# 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Comply with NFPA 20.
- B. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Component Importance Factor: 1.5.
- C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

- A. Description: Factory-assembled and -tested fire-pump and driver unit.
- B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.
- C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

#### 2.3 IN-LINE FIRE PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A-C Fire Pump; a Xylem brand.
  - 2. Aurora.
  - 3. Fairbanks.
- B. Pump:
  - 1. Standard: UL 448, for in-line pumps for fire service.
  - 2. Casing: Radially split case, cast iron, with ASME B16.1 pipe-flange connections.
  - 3. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft.
  - 4. Wear Rings: Replaceable bronze.
  - 5. Shaft and Sleeve: Steel shaft with bronze sleeve.

- a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
- b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
- 6. Mounting: Pump and driver shaft is vertical, with motor above pump and pump on base. Motor and pump rotating assembly shall be removable from top without removing the pump casing from the piping.
- C. Coupling: None or rigid.
- D. Driver:
  - 1. Standard: UL 1004A.
  - 2. Type: Electric motor; NEMA MG 1, polyphase Design B.
- 2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES
  - A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.
  - B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.
  - C. Relief Valves:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. BERMAD Control Valves.
      - b. CLA-VAL Automatic Control Valves.
      - c. Kunkle Valve.
      - d. OCV Control Valves.
      - e. WATTS.
      - f. Zurn Industries, LLC.
    - 2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in firesuppression water-supply piping.
  - D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.
  - E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.
  - F. Discharge Cone: Closed or open type.
  - G. Hose Valve Manifold Assembly:
    - 1. Standard: Comply with requirements in NFPA 20.
    - 2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
    - 3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
    - 4. Automatic Drain Valve: UL 1726.
    - 5. Manifold:

- a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
- b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
- c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
- d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
- e. Escutcheon Plate: Brass or bronze; rectangular.
- f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
- g. Exposed Parts Finish: Polished, chrome plated.
- h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

# 2.5 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.
- 2.6 SOURCE QUALITY CONTROL
  - A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
    - 1. Verification of Performance: Rate fire pumps according to UL 448.
  - B. Fire pumps will be considered defective if they do not pass tests and inspections.
  - C. Prepare test and inspection reports.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.
- B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.
- B. Equipment Mounting:
  - 1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.
- D. Support piping and pumps separately, so weight of piping does not rest on pumps.
- E. Install valves that are same size as connecting piping. Comply with requirements for fireprotection valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."
- F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 211313 "Wet-Pipe Sprinkler Systems."
- G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.
- H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.
- I. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

# 3.3 ALIGNMENT

- A. Align pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.
- B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.
- C. Align piping connections.
- D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

# 3.4 CONNECTIONS

- A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps and equipment to allow service and maintenance.
- C. Connect relief-valve discharge to drainage piping or point of discharge.
- D. Connect fire pumps to their controllers.

# 3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

# 3.6 FIELD QUALITY CONTROL

- A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motordriver fire-pump controllers specified in Section 262933 "Controllers for Fire-Pump Drivers."
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  - 1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
  - 2. Test according to NFPA 20 for acceptance and performance testing.
  - 3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

# 3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

# 3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213113

# SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Plumbing demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Painting and finishing.
  - 11. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.

- 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

# 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Utilization of plastic piping components within building is not permitted without written authorization from DECA.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

# 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Flexible water hoses supplying appliances or HVAC equipment shall be protected and reinforced with metal braiding of a material appropriate for the application.

#### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 2. PVC to ABS Piping Transition: ASTM D 3138.

# 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.

# 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035or 2070-kPa) minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- 1. Manufacturers:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
- 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

# 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless Steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

# 2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

# 2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chromeplated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

# 2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

### 3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

# 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.

- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsumboard partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

- 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
- 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
- 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.3 PIPING JOINT CONSTRUCTION
  - A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
  - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
  - E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
  - F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
  - G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 4. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- I. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

# 3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

# 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing 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.
- D. Install equipment to allow right of way for piping installed at required slope.

# 3.6 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

# 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

# 3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

# END OF SECTION 220500

# SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

# PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Filled-system thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
- B. Related Requirements:
  - 1. Section 221113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
  - 2. Section 221119 "Domestic Water Piping Specialties" for water meters.
  - 3. Section 221513 "General-Service Compressed-Air Piping" for compressed air gages.

# 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

# 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

# PART 2 - PRODUCTS

# 2.1 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Trerice, H. O. Co.
    - b. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.200.
  - 3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
  - 4. Element: Bourdon tube or other type of pressure element.
  - 5. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
  - 7. Pointer: Dark-colored metal.
  - 8. Window: Glass.
  - 9. Ring: Metal.
  - 10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
  - 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 12. Accuracy: Plus or minus 1 percent of scale range.
  - 13. Temperature Range: 30 to 240 F with 2 degree scale divisions.

# 2.2 THERMOWELLS

#### A. Thermowells:

- 1. Standard: ASME B40.200.
- 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
- 3. Material for Use with Copper Tubing: CNR or CUNI.
- 4. Material for Use with Steel Piping: CRES or CSA.
- 5. Type: Stepped shank unless straight or tapered shank is indicated.
- 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25), ASME B1.20.1 pipe threads.
- 7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
- 8. Bore: Diameter required to match thermometer bulb or stem.
- 9. Insertion Length: Length required to match thermometer bulb or stem.
- 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
- 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

# 2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Trerice, H. O. Co.
    - b. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.100.
  - 3. Case: Dry Type unless liquid filled type is indicated type(s); drawn steel; 4-1/2-inch (114-mm) nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass.
  - 10. Ring: Metal, Brass, Stainless steel.
  - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
  - 12. Range: Two times the operating pressure.

### 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

# 2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Trerice, H. O. Co.
  - 2. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: EPDM self-sealing rubber.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
  - 1. Outlet of each thermostatic mixing valve.
  - 2. Return circulating pump outlet.
- J. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Suction and discharge of each domestic water pumps, circulating and booster pump(s).

### 3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

# 3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

### END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Bronze swing check valves.
  - 3. Iron butterfly valves.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
  - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

### 1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

# PART 2 - PRODUCTS

# 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
  - 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

- 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

# 2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve
    - c. Crane
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig (1035 kPa).
    - c. CWP Rating: 600 psig (4140 kPa).
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.

# 2.3 BRONZE SWING CHECK VALVES

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.

- b. CWP Rating: 300 psig (2070 kPa).
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

# 2.4 IRON, SINGLE FLANGE BUTTERFLY VLAVES

- A. Manufacturers and Description:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Crane Co.; Crane Valves Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division
    - d. Hammond Valve.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    - e. Ends: EPDM.
    - f. Stem: One- or two-piece stainless steel.
    - g. Disc: Aluminum bronze.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

# 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Lift Check Valves: With stem upright and plumb.

### 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

# 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball and butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solderjoint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

# 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Ball Valves: Two piece, Full port, bronze with bronze trim.
  - 3. Bronze Swing Check Valves: Class 150 bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron Butterfly Valves: 200 CMP, EPDM seat, aluminum bronze disc.

# END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for firesuppression piping.
  - 3. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

# 1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

### 1.5 SUBMITTALS

A. Product Data: For the following:

- 1. Steel pipe hangers and supports.
- 2. Thermal-hanger shield inserts.
- 3. Powder-actuated fastener systems.
- 4. Pipe positioning systems.

### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 4. ASME Boiler and Pressure Vessel Code: Section IX.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

# 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Empire Industries, Inc.
  - 3. ERICO/Michigan Hanger Co.
  - 4. Grinnell Corp.
  - 5. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

# 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. Power-Strut Div.; Tyco International, Ltd.
  - 4. Thomas & Betts Corporation.
  - 5. Tolco Inc.
  - 6. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

### 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
  - 1. ERICO/Michigan Hanger Co.
  - 2. Pipe Shields, Inc.
  - 3. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

### 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Masterset Fastening Systems, Inc.
Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- d. MKT Fastening, LLC.
- e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type [zinc-coated] [stainless] steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

# 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

## 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

- Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
- 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
- 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
- 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
- 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
- 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
- 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
- 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
- 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
- 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
- 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
- Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
- 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
- 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
  - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
  - 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  - 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  - 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  - 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
- 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

## 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

# 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

# 3.5 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section includes the following:1. Restraining braces and cables.

#### 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: C
  - 2. Assigned Seismic Use Group or Building Risk Category as Defined in the IBC: LII
  - 3. Seismic Design Category: D.

# 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Qualification Data: For professional engineer and testing agency.
- D. Field quality-control test reports.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

# PART 2 - PRODUCTS

#### 2.1 SEISMIC-RESTRAINT DEVICES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on drawings or a comparable product by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti, Inc.
  - 5. Kinetics Noise Control.
  - 6. Loos & Co.; Cableware Division.
  - 7. Mason Industries.
  - 8. TOLCO Incorporated; a brand of NIBCO INC.
  - 9. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

## 3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  - 3. Brace a change of direction longer than 12 feet (3.7 m).
- B. Install cables so they do not bend across edges of adjacent equipment or building structure.
- C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- E. Drilled-in Anchors:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

- 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
- 5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

# 3.4 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 220548

# SECTION 220553 – IDENTIFICATION FOR PIPING AND EQUIPMENT

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
  - 1. Equipment nameplates.
  - 2. Equipment markers.
  - 3. Access panel and door markers.
  - 4. Pipe markers.
  - 5. Valve tags.
  - 6. Valve schedules.
  - 7. Warning tags.

#### 1.3 QUALITY ASSURANCE

A. 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.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

# PART 2 - PRODUCTS

- 2.1 EQUIPMENT IDENTIFICATION DEVICES
  - A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
    - 1. Data:

- a. Manufacturer, product name, model number, and serial number.
- b. Capacity, operating and power characteristics, and essential data.
- c. Labels of tested compliances.
- 2. Location: Accessible and visible.
- 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number.
  - 3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- C. Access Panel and Door Markers: 1/16-inch- (1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

# 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
  - 4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- C. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressuresensitive, permanent-type, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
  - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

## 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme approved by Architect and Owner. Provide 5/32-inch (4-mm) hole for fastener.
  - 1. Material: 0.032-inch- (0.8-mm-) thick brass.
  - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

# 2.4 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

# PART 3 - EXECUTION

## 3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

## 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
  - 1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  - 2. Heat exchangers, coils, evaporators, cooling towers, steam generators, water heaters, and similar equipment.
  - 3. Fans, blowers, primary balancing dampers, and mixing boxes.
  - 4. Control Devices requiring manual input.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
  - 1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

- a. Pumps, compressors, chillers, condensers, and similar motor-driven units.
- b. Heat exchangers, coils, evaporators, cooling towers, steam generators, water heaters, and similar equipment.
- c. Fans, blowers, primary balancing dampers, and mixing boxes.
- d. Tanks and pressure vessels.
- e. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- f. Control devices requiring manual input.
- C. Install access panel markers with screws on equipment access panels.

# 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
  - 1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.
  - 2. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch (19 mm), 1-1/2 inches (38 mm) wide, lapped at least 1-1/2 inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.
  - 3. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
  - 4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

# 3.4 VALVE-TAG INSTALLATION

A. Install 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; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
  - 1. Valve-Tag Size and Shape:
    - a. All Systems: 1-1/2 inches (38 mm), round.
  - 2. Valve-Tag Color:
    - a. All Systems: Natural.
  - 3. Letter Color:
    - a. All Systems: Black.

## 3.5 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

## 3.6 CLEANING

A. Clean faces of mechanical identification devices.

# END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Tapes.
  - 8. Securements.
- B. Related Sections include the following:
  - 1. Division 23 Section "HVAC Insulation."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

# 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000(Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factor applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

# 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.

- e. Mon-Eco Industries, Inc.; 55-40.
- f. Vimasco Corporation; 749.
- 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
- 5. Color: White.

# 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-52.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    - c. Marathon Industries, Inc.; 130.
    - d. Mon-Eco Industries, Inc.; 11-30.
    - e. Vimasco Corporation; 136.
  - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over equipment and pipe insulation.
  - 3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).
  - 4. Color: White.

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

## 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following::
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: <u>3 inches (75 mm)</u>.
  - 3. Thickness: 11.5 mils (0.29 mm).
  - 4. Adhesion: <u>90 ounces force/inch (1.0 N/mm) in width.</u>
  - 5. Elongation: 2 percent.

- 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.8 SECUREMENTS

## A. Bands:

- 1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products; Bands.
  - b. PABCO Metals Corporation; Bands.
  - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.
- 3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

## 3.4 PENETRATIONS

- A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fireresistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

## 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular

surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

- 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

# 3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
  - 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

# 3.7 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

## 3.8 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: <sup>1</sup>/<sub>2</sub> inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and larger: Insulation shall be the following:
    - a. Mineral Fiber, Preformed Pipe Insulation Type I: 1-1/2 inch thick.

- C. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C) excluding freezer/cooler:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick
- D. Condensate from freezer/cooler shall be  $\frac{3}{4}$ " flexible elastomeric insulation.

END OF SECTION 220700

SECTION 221116 - DOMESTIC WATER PIPING

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Escutcheons.

#### 1.3 SUBMITTALS

- A. Product Data: For the following products:
  - 1. Dielectric fittings.
  - 2. Escutcheons.
- B. Water Samples: Specified in "Cleaning" Article.
- C. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

#### 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's written permission.

# PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
  - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-andsocket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

## 2.4 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.

#### 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. EPCO Sales, Inc.
  - d. Hart Industries International, Inc.
  - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
- 2. Description:
  - a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
  - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
  - 2. Description:
    - a. Galvanized-steel coupling.
    - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - c. End Connections: Female threaded.
    - d. Lining: Inert and noncorrosive, thermoplastic.

## 2.6 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polishes, chrome-plated or rough-brass finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.
- E. Split Casting, Cast Brass: Polished chrome plated or rough brass finish with concealed hinge and setscrew.
- F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

#### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install domestic water piping level without pitch and plumb.
- E. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping adjacent to equipment and specialties to allow service and maintenance.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

#### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

- 1. Apply appropriate tape or thread compound to external pipe threads.
- 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

# 3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

## 3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings.

## 3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

- 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
  - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  - 4. NPS 2-1/2: 108 inches with  $\frac{1}{2}$  inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with  $\frac{1}{2}$  inch rod.
- F. Install supports for vertical copper tubing every 10 feet (3 m).
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

#### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

## 3.7 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, stamped steel with set screw or spring clips.
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split plate, stamped steel with set screw.

# 3.8 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

## 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## 3.10 ADJUSTING

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.
- 2. Open shutoff valves to fully open position.
- 3. Open throttling valves to proper setting.
- 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

#### 3.11 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

## 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Aboveground domestic water piping, NPS 4 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) cast- or wrought- copper solder-joint fittings; and soldered joints.

END OF SECTION 221116

# SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
  - 1. Backflow Preventers
  - 2. Balancing valves.
  - 3. Strainers.
  - 4. Hose bibbs.
  - 5. Wall hydrants.
  - 6. Drain valves.
  - 7. Water hammer arresters.
  - 8. Temperature Actuated Mixing Valves

#### 1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9."
PART 2 - PRODUCTS

1.

# 2.1 BACKFLOW PREVENTER

- A. Reduced-Pressure-Principle Backflow Preventers:
  - Provide Products by one of the following:
    - a. Watts
    - b. Zurn Industries
    - c. Apollo
  - 2. Standard: ASSE 1013.
  - 3. Operation: Continuous pressure applications.
  - 4. Pressure Loss: 10 psig (kPa) maximum, through middle third of flow range.
  - 5. Body: Bronze for NPS 2 (DN 50) and smaller; See plans for additional requirements.
  - 6. End Connections: Threaded for NPS 2 (DN 50) and smaller.
  - 7. Configuration: Designed for horizonal flow.
  - 8. Accessories:
    - a. Valves NP 2 (DN 50) and smaller: Ball type with threaded ends on inlet and outlet.
    - b. Air Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

# 2.2 BALANCING VALVES

- A. Copper-Alloy Calibrated Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong International, Inc.
    - b. ITT Industries; Bell & Gossett Div.
  - 2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
  - 3. Body: Brass or bronze.
  - 4. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
  - 5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

## 2.3 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
  - 1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
  - 2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron for NPS 2-1/2 (DN 65) and larger.
  - 3. End Connections: Threaded for NPS 2 (DN 50) and smaller;flanged for NPS 2-1/2 (DN 65) and larger.
  - 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
  - 5. Drain: Pipe plug.

#### 2.4 HOSE BIBBS

A. Hose Bibbs:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - b. Woodford Manufacturing Company.
  - c. Zurn Plumbing Products Group; Specification Drainage Operation
- 2. Refer to Schedule on Drawings.

# 2.5 WALL HYDRANTS

- A. Nonfreeze Wall Hydrants:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - b. Woodford Manufacturing Company.
    - c. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Refer to Schedule on Drawings.

## 2.6 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
  - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
  - 2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
  - 3. Size: NPS 3/4 (DN 20).
  - 4. Body: Copper alloy.
  - 5. Ball: Chrome-plated brass.
  - 6. Seats and Seals: Replaceable.
  - 7. Handle: Vinyl-covered steel.
  - 8. Inlet: Threaded or solder joint.
  - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.7 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. PPP Inc.
    - e. Sioux Chief Manufacturing Company, Inc.
    - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - g. Tyler Pipe; Wade Div.

- h. Watts Drainage Products Inc.
- i. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASSE 1010 or PDI-WH 201.
- 3. Type: Metal bellows.
- 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

### 2.8 TEMPERATURE ACTUATION MIXING VALVES

- A. Primary, Thermostatic, Water Mixing Valves:
  - 1. Provide products by one of the following:
    - a. Symmons
    - b. Watts
    - c. Leonard
    - d. Apollo
  - 2. Standard: ASSE 1017.
  - 3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
  - 4. Type: Exposed mounted, thermostatically controlled, water mixing valve.
  - 5. Material: Bronze body with corrosion resistant interior components.
  - 6. Connections: Threaded union inlets and outlet.
  - 7. Accessories: Manual temperature control, check stops on hot- or cold-water supplies, and adjustable, temperature control handle.
  - 8. See plans for additional requirements.
  - 9. Valve Finish: Rough bronze.
  - 10. Piping Finish: Copper.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install Y-pattern strainers for water on supply side of each control valve.
- D. Install water hammer arresters in water piping according to PDI-WH 201.

## 3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

# 3.3 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

## 3.4 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

## SECTION 221123.13 - DOMESTIC-WATER PACKAGED BOOSTER PUMPS

### 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. Duplex, variable-speed booster pumps.
- B. Related Requirements:
  - 1. Section 221123 "Domestic Water Pumps" for domestic-water circulation pumps.

### 1.3 DEFINITIONS

- A. PID: Proportional Integral Derivative.
- B. VFC: Variable-frequency controller.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, and dimensions of individual components and profiles.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For booster pumps.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For domestic-water packaged booster pumps.
  - 1. Include design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for booster pumps, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.
- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Retain protective coatings and flange's protective covers during storage.

### 1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Drinking Water System Components Health Effects and Drinking Water System Components Lead Content Compliance: NSF 61 and NSF 372.
- B. Seismic Performance: Booster pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and IBC seismic design.
  - 1. The term "withstand" means "the booster pump will remain in place without separation of any parts from the booster pump when subjected to the seismic forces specified and the booster pump will be fully operational after the seismic event."

## 2.2 DUPLEX, VARIABLE-SPEED BOOSTER PUMPS

- A. Provide produces by one of the following:
  - 1. Bell & Gossett; a Xylen brand
  - 2. Armstrong Pumps, Inc.
  - 3. Grundfos Pumps Corporation, USA

- B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.
- C. Pumps:
  - 1. Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.
  - 2. Casing: Cast-iron or steel base and stainless-steel chamber.
  - 3. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
  - 4. Shaft: Stainless steel.
  - 5. Seal: Mechanical.
  - 6. Bearing: Water-lubricated sleeve type.
- D. Motors: Single speed, with pre-greased, permanently shielded, ball-bearings. Select motors that will not overload through full range of pump performance curve.
- E. Piping: Stainless-steel pipe and fittings.
- F. Valves:
  - 1. Shutoff Valves NPS 2 (DN 50) and Smaller: two-piece, full-port ball valve, in each pump's suction and discharge piping.
  - 2. Check Valves NPS 2 (DN 50) and Smaller: Silent or swing type in each pump's discharge piping.
  - 3. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.
- G. Dielectric Fittings: With insulating material to isolate joined dissimilar metals.
- H. VFD: Serving each pump in pump array.
  - 1. Manufactured Units: Pulse-width modulated; for motors.
  - 2. Unit Operating Requirements:
    - a. Internal Adjustability:
      - 1) Minimum Speed: 5 to 25 percent of maximum rpm.
      - 2) Maximum Speed: 80 to 100 percent of maximum rpm.
      - 3) Acceleration: seconds.
      - 4) Deceleration: seconds.
      - 5) Current Limit: 30 to minimum of 150 percent of maximum rating.
    - b. Self-Protection and Reliability Features:
      - 1) Surge suppression.
      - 2) Loss of input signal protection.
      - 3) Under- and overvoltage trips.
      - 4) VFD and motor overload/overtemperature protection.
      - 5) Critical frequency rejection.
      - 6) Loss-of-phase protection.
      - 7) Reverse-phase protection.
      - 8) Motor-overtemperature fault.

- 3. Instrumentation: Suction and discharge pressure gauges.
- 4. Thermal-bleed cutoff.
- 5. Low-suction-pressure cutout.
- 6. High-suction-pressure cutout.
- 7. Low-discharge-pressure cutout.
- 8. High-discharge-pressure cutout.
- 9. Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to BACnet DDC system. DDC systems are specified in Section 230900 "Buildign Automation System." Include the following:
  - a. On-off status of each pump.
  - b. Alarm status.
- I. Base: Structural steel.
- J. Capacities and Characteristics:
  - 1. See drawings for additional requirements.

# 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

# 2.4 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. ASME Compliance: Comply with ASME B31.9 for piping.
- C. UL Compliance for Packaged Pumping Systems:
  - 1. UL 508, "Industrial Control Equipment."
  - 2. UL 508A, "Industrial Control Panels."
  - 3. UL 778, "Motor-Operated Water Pumps."
  - 4. UL 1995, "Heating and Cooling Equipment."
- D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

### 3.2 INSTALLATION

- A. Booster-Pump Mounting:
  - 1. Install booster pumps on cast-in-place concrete equipment base(s).
  - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Support connected domestic-water piping so weight of piping is not supported by booster pumps.

#### 3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

#### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

#### 3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

## 3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

- B. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

# 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections with the assistance of a factory-authorized service representative.
  - 1. Perform visual and mechanical inspection.
  - 2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Pumps and controls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

#### 3.8 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

## 3.9 ADJUSTING

- A. Adjust booster pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust pressure set points.
- C. Occupancy Adjustments: When requested within 6 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

# 3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION 221123.13

## SECTION 221123 - DOMESTIC WATER PUMPS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
  - 1. Close-coupled, in-line, sealless centrifugal pumps.

## 1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product 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, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

## 1.6 COORDINATION

A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 CLOSE COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Manufacturers:
  - 1. Bell & Gossett Domestic Pump; ITT Industries.
  - 2. Taco, Inc.
  - 3. Armstrong.
- B. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.
  - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
  - 2. Casing: Bronze, with threaded companion-flange connections.
  - 3. Impeller: Corrosion-resistant material.
  - 4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

## 2.3 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  - 1. Manufacturers:
    - a. Honeywell International, Inc.
    - b. Square D.
    - c. White-Rodgers Div.; Emerson Electric Co.
  - 2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
  - 3. Range: 50 to 125 deg F (10 to 52 deg C).
  - 4. Operation of Pump: On or off.
  - 5. Transformer: Provide if required.
  - 6. Power Requirement: 120 V, ac.

- B. Timers: Electric time clock for control of hot-water circulation pump.
  - 1. Manufacturers:
    - a. Honeywell International, Inc.
    - b. Intermatic, Inc.
    - c. Johnson Controls, Inc.
    - d. Maple Chase Company.
    - e. TORK.
  - 2. Type: Programmable, seven-day clock with manual override on-off switch.
  - 3. Enclosure: Suitable for wall mounting.
  - 4. Operation of Pump: On or off.
  - 5. Transformer: Provide if required.
  - 6. Power Requirement: 120 V, ac.
  - 7. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.
- 3.2 PUMP INSTALLATION
  - A. Comply with HI 1.4.
  - B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
  - C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
  - D. Install in-line, sealless centrifugal pumps with motor and pump shafts horizontal.
  - E. Install continuous-thread hanger rods and elastomeric hangers of sufficient size to support pump weight. Vibration isolation devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

#### 3.3 CONTROL INSTALLATION

- A. Install immersion-type thermostats in hot-water return piping.
- B. Install timers.
- 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
  - Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
  - 2. Install pressure gages at suction and discharge of pumps. Install at integral pressuregage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Connect thermostats and timers to pumps that they control.

# 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set thermostats and timers for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. 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.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

## 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 221123

# SECTION 221316 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
  - 1. Division 22 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

## 1.3 DEFINITIONS

A. The following are industry abbreviations for plastic rubber piping materials:
 1. EPDM: Ethylene-propylene-diene terpolymer rubber.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation shall be capable of producing piping systems with the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

#### 1.5 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

### 1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

# PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

### 2.2 CAST-IRON SOIL PIPING

- A. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
  - 1. Compact, Stainless Steel Couplings: CISPI 310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless steel corrugated shield; stainless steel bands; and sleeve.
    - a. NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 2-1/8 inch (54-mm) wide shield with 2 bands.
    - b. NPS 5 and NPS 6 (DN125 and DN150): 3-inch (76-mm) wide shield with 4 bands.

### 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

## PART 3 - EXECUTION

#### 3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil and waste piping NPS 4 (DN100): Use any of the following piping materials for each size range:
  - 1. NPS1-1/4 and NPS 1-1/2 (DN 32 and DN40) Use NPS 1-1/2 (DN 40) hubless, cast iron soil piping and one of the following:
    - a. Couplings: Compact, stainless steel.
  - 2. NPS2 to NPS 4 (DN 50 to DN 100): Hubless cast-iron soil pipe and one of the following:
    - a. Couplings: Compact, stainless steel.
- D. Underground, soil, waste, and vent piping: Use any of the following piping materials for each size range:

1. NPS 2 to NSP 6: Solid wall PVC pipe, PVC socket fittings and solvent cemented joints.

### 3.2 PIPING INSTALLATION

- A. Refer to Division 22 Section "\_\_\_\_\_" for basic piping installation.
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- D. Install cast iron soil piping according to CISPIs "Cast Iron Soil Pipe and Fittings Handbook" Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Sanitary Piping: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

### 3.3 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Cast-Iron, Soil Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook", Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".
1. Hubless Joints: Make with rubber gasket and sleeve or clamp.

# 3.4 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Vibration Isolation and Seismic Restraints: for seismic restraint devices.
- B. Refer to Division 22 Section "Hangers and Supports" for ppie hanger and support devices. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet (30 m), if indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast-iron piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch (10-mm) rod.
  - 2. NPS 3 (DN80): 60 inches with 1/2-inch (13-mm) rod.
  - 3. NPS 4 to NPS 5 (DN 100 and DN 125): 60 inches with 5/8 inch rod.
  - 4. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3m). Spacing for fittings is limited to 60 inches (1500 mm).
- G. Install supports for vertical cast iron piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

## 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:

- 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures".
- 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
- 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties".
- 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

# 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

# 3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

# SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
- B. Related Sections include the following:
  - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
  - 2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

#### 1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
  - 1. Floor drains.

# 1.5 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

## PART 2 - PRODUCTS

# 2.1 CLEANOUTS

- A. Metal Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Zurn Plumbing Products Group; Specification Drainage Operation.

## 2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.

## PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.

- 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
- 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- G. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- H. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

## 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

## 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

## END OF SECTION 221319

# SECTION 221413 - FACILITY STORM DRAINAGE PIPING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following storm drainage piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.

### 1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.
- B. TPE: Thermoplastic elastomer.

# 1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum workingpressure, unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water (30 kPa).
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

## 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

# 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

# PART 2 - PRODUCTS

## 2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

### 2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shield Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - 1. Standard, Shielded, Stainless-steel Couplings: CISPI 310, with stainless-steel corrugated shield, stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturer:
      - 1) ANACO
        - 2) Fernco, Inc.
        - 3) Ideal Div., Stant Corp.
        - 4) Mission Rubber Co.
        - 5) Typer Pipe; Soil Pipe Div.

### 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
  - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

## 3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

## 3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

- B. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Underground, storm drainage piping NPS 8 (DN 200) and larger shall be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, storm drainage piping NPS 6 and smaller shall be the following:
   1. Hubless cast iron soil piping and fittings; standard, shielded, stainless-steel couplings; and hubless coupling joints.

## 3.3 PIPING INSTALLATION

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Utility Drainage Piping."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Storm Drainage Piping Specialities."
- E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Fire Plumbing."
- F. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install PVC storm drainage piping according to ASTM D 2665.

- K. Install underground PVC storm drainage piping according to ASTM D 2321.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Install cast iron soil piping according to CISPI "Cast Iron Soil Pipe and Fittings Handbook: Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results Plumbing."
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

## 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches with 3/8-inch (10-mm) rod.
  - 2. NPS 3 (DN 80): 60 inches with 1/2-inch (13-mm) rod.
  - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches with 5/8-inch (16-mm) rod.
  - 4. NPS 6 (DN 150): 60 inches with 3/4-inch (19-mm) rod.
- G. Install supports for vertical cast iron soil piping every 4 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

# 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.

# 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

# 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221413

## SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous storm drainage piping specialties.
  - 2. Cleanouts.
  - 3. Roof drains.
- 1.3 SUBMITTALS
  - A. Product Data: For each type of product indicated.
- 1.4 QUALITY ASSURANCE
  - A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- PART 2 PRODUCTS
- 2.1 CLEANOUTS AND ROOF DRAINS
  - A. Cleanouts and Roof Drains:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Josam Company.
      - b. Smith, Jay R. Mfg. Co.
      - c. Froex.
      - d. Watts Water Technologies, Inc.
      - e. Zurn.

# PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- 3.2 CONNECTIONS
  - A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- 3.3 PROTECTION
  - A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
  - B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

# SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Power-vent, gas-fired, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

#### 1.4 SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- B. Product Certificates: For each type of residential, gas-fired, domestic-water heater, from manufacturer.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

# 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

# 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. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domesticwater heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components Health Effects."

# 1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

# 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.

- b. Faulty operation of controls.
- c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Periods: From date of Substantial Completion.
  - a. Residential, Gas-Fired, Storage, Domestic-Water Heaters:
    - 1) Storage Tank: Five years.
    - 2) Controls and Other Components: Two years.

# PART 2 - PRODUCTS

## 2.1 GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

- A. Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lochinvar, LLC.
    - b. Rheem Manufacturing Company.
    - c. A.O. Smith Corporation.
    - d. Approved equal prior to bid.
  - 2. Standard: ANSI Z21.10.1/CSA 4.1.
  - 3. Storage-Tank Construction: Steel.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig (1035 kPa).
    - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.
  - 4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1.
    - e. Jacket: Steel with enameled finish.
    - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    - g. Burner: For use with power-vent, gas-fired, domestic-water heaters and naturalgas fuel.
    - h. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gasignition system.
    - i. Temperature Control: Adjustable thermostat.
    - j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4-M. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
  - 5. Power-Vent System: Exhaust fan, interlocked with burner.
- B. Capacity and Characteristics:
  - 1. See drawings for capacities and other requirements.

# 2.2 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Wessel.
    - c. Watts.
    - d. Bell and Gossett.
    - e. Approved equal prior to bid.
  - 2. Description: Steel, pressure-rated tank constructed with welded joints and factoryinstalled butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  - 3. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  - 4. Capacity and Characteristics:
    - a. Refer to drawings for capacity and other requirements.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- D. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "General Duty Valves to Plumbing Piping."
  - 1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include pressure rating as required to match gas supply.

- G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- I. Pressure Relief Valves: Include pressure setting less than domestic-water heater workingpressure rating.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- 2.3 SOURCE QUALITY CONTROL
  - A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

# PART 3 - EXECUTION

## 3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Domestic-Water Heater Mounting: Install residential domestic-water heaters on floor.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General Duty Valves to Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.

- 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."
- D. Install domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

# 3.2 CONNECTIONS

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

# 3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

# 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 223400

SECTION 224000 - PLUMBING FIXTURES

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
  - 1. Faucets for lavatories and sinks.
  - 2. Flushometers.
  - 3. Toilet seats.
  - 4. Protective shielding guards.
  - 5. Fixture supports.
  - 6. Water closets.
  - 7. Urinals.
  - 8. Lavatories.
  - 9. Sinks.
- B. Related Sections include the following:
  - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
  - 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
  - 3. Division 22 Section "Drinking Fountains and Water Coolers."

#### 1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.

- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

## 1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Vitreous-China Fixtures: ASME A112.19.2M.
  - 2. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

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- 3. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory faucets:
  - 1. Faucets: ASME A112.18.1.
  - 2. NSF Potable-Water Materials: NSF 61.
  - 3. Pipe Threads: ASME B1.20.1.
  - 4. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 5. Supply Fittings: ASME A112.18.1.
  - 6. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - 1. Atmospheric Vacuum Breakers: ASSE 1001.
  - 2. Brass and Copper Supplies: ASME A112.18.1.
  - 3. Manual-Operation Flushometers: ASSE 1037.
  - 4. Brass Waste Fittings: ASME A112.18.2.
  - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Flexible Water Connectors: ASME A112.18.6.
  - 2. Floor Drains: ASME A112.6.3.
  - 3. Grab Bars: ASTM F 446.
  - 4. Hose-Coupling Threads: ASME B1.20.7.
  - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 6. Pipe Threads: ASME B1.20.1.
  - 7. Plastic Toilet Seats: ANSI Z124.5.
  - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures of unit shell.
    - b. Faulty operation of controls, blowers, pumps, heaters, and timers.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Period for Commercial Applications: One year from date of Substantial Completion.

PART 2 - PRODUCTS

# 2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Chicago Faucets.
    - b. Symmons Industries.
    - c. Delta
    - d. Sloan
    - e. American Standard
  - 2. Description: Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor. Refer to Schedule of Drawings.

## 2.2 SINK FAUCETS

- A. Sink Faucets:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Chicago Faucets.
    - b. Symmons Industries, Inc.
    - c. Delta.
    - d. Sloan
    - e. American Standard

## 2.3 FLUSHOMETERS

- A. Flushometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sloan Valve Company.
    - b. Zurn
    - c. American Standard
  - 2. Description: Flushometer for urinal and water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts. Refer to Schedule on Drawings.

# 2.4 TOILET SEATS

- A. Toilet Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bemis Manufacturing Company.
    - b. Centoco Manufacturing Corp.
    - c. Church Seats.
    - d. Olsonite Corp.
    - e. Sanderson Plumbing Products, Inc.; Beneke Div.
  - 2. Description: Toilet seat for water-closet-type fixture.
    - a. Material: Molded, solid plastic with antimicrobial agent.
    - b. Configuration: Open front without cover.
    - c. Size: Elongated.
    - d. Hinge Type: SC, self-sustaining, check.

# 2.5 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Plumberex Specialty Products Inc.
    - b. TRUEBRO, Inc.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply, hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.6 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Company.
  - 2. MIFAB Manufacturing Inc.
  - 3. Smith, Jay R. Mfg. Co.
  - 4. Tyler Pipe; Wade Div.
  - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
  - 1. Description: Combination carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Urinal Supports:

- 1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
- 2. Accessible-Fixture Support: Include rectangular steel uprights.

# 2.7 WATER CLOSETS

- A. Water Closets:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following for flush valve water closets:
    - a. American Standard Companies, Inc.
    - b. Crane Plumbing, L.L.C./Fiat Products.
    - c. Eljer.
    - d. Kohler Co.
  - 2. Description: Refer to Schedule on Drawings.

## 2.8 URINALS

- A. Urinals:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Crane Plumbing, L.L.C./Fiat Products.
    - c. Eljer.
    - d. Kohler Co.
  - 2. Description: Refer to Schedule on Drawings.
    - a. Type: Siphon jet.

# 2.9 SINKS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Just
  - 2. Elkay

## 2.10 LAVATORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Standard
  - 2. Crane
  - 3. Eljer
  - 4. Kohler

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- L. Install toilet seats on water closets.

- M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- P. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

## 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

## 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

## 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.

# 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

## 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

# SECTION 224700 - DRINKING FOUNTAINS AND WATER COOLERS

## PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section includes the following water coolers and related components:1. Pressure water coolers.

#### 1.3 DEFINITIONS

- A. Accessible Water Cooler: Fixture that can be approached and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of fixture.
- C. Fixture: Drinking fountain or water cooler unless one is specifically indicated.
- D. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

#### 1.4 SUBMITTALS

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

- E. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.
- PART 2 PRODUCTS
- 2.1 PRESSURE WATER COOLERS
  - A. Water Coolers:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Elkay Manufacturing Co.
      - b. Haws Corporation.
      - c. Oasis Corporation.
    - 2. Description: Refer to Schedule on Drawings.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATIONS

- A. Use mounting frames for recessed water coolers, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

## 3.3 INSTALLATION

- A. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
- B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

#### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

#### 3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
  - 1. Remove and replace malfunctioning units and retest as specified above.
  - 2. Report test results in writing.

#### 3.6 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

#### 3.7 CLEANING

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 224700

# SECTION 230500 - COMMON WORK RESULTS FOR HVAC

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. HVAC demolition.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Concrete bases.
  - 11. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
  - 2. PE: Polyethylene plastic.
  - 3. PVC: Polyvinyl chloride plastic.

- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

## 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Utilization of plastic piping components within building is not permitted without written authorization from DECA.

# 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

## 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

# 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. Flexible water hoses supplying appliances or HVAC equipment shall be protected and reinforced with metal braiding of a material appropriate for the application.

## 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. 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.
- E. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
  - 1. Available Manufacturers:
    - a. Capitol Manufacturing Co.

- b. Central Plastics Company.
- c. Eclipse, Inc.
- d. Epco Sales, Inc.
- e. Hart Industries, International, Inc.
- f. Watts Industries, Inc.; Water Products Div.
- g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035or 2070-kPa) minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Central Plastics Company.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Available Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Available Manufacturers:
    - a. Grinnell Corp.
    - b. Grinnell Supply Sales Co.
    - c. Perfection Corp.
    - d. Victaulic Co. of America.
- 2.5 SLEEVES
  - A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. Split-Plate, Stamped-Steel Type: With concealed or exposed-rivet hinge, spring, set screw or spring clips, and chrome-plated finish.
- F. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- G. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

# 2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

# 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

- a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
- b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
  - 1) Seal space outside of sleeve fittings with grout.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- R. Verify final equipment locations for roughing-in.

## 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

## 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

#### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC 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.
- D. Install equipment to allow right of way for piping installed at required slope.

## 3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

## 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

- 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

# 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

# 3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

# END OF SECTION 230500

# SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

#### PART 2 - PRODUCTS

## 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

#### 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

# 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficiency for motors 1 HP and higher, high efficiency for <sup>3</sup>/<sub>4</sub> HP and lower as defined in NEMA MG 1 and ASHRAE 90.1-2004.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 7.5 hp and larger; rolled steel for motor frame sizes smaller than 7.5 hp.

# 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

# 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

# SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Thermometers.
  - 2. Gages.
  - 3. Test plugs.
- B. Related Sections:
  - 1. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

### 1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

#### PART 2 - PRODUCTS

## 2.1 DIRECT-MOUNTING, VAPOR-ACTUATED DIAL THERMOMETERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Marsh Bellofram.
  - 3. Trerice, H. O. Co.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: drawn steel or cast aluminum, 4-1/2-inch (114-mm) diameter.
- C. Element: Bourdon tube or other type of pressure element.

- D. Movement: Mechanical, connecting element and pointer.
- E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- F. Pointer: Red metal.
- G. Window: Glass or plastic.
- H. Ring: Metal.
- I. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- J. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem for thermowell installation and of length to suit installation.
- K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

## 2.2 THERMOWELLS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Manufacturers: Same as manufacturer of thermometer being used.
- C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

## 2.3 PRESSURE GAGES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch (114-mm) diameter.
  - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  - 3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
  - 4. Movement: Mechanical, with link to pressure element and connection to pointer.

- 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- 6. Pointer: Red metal.
- 7. Window: Glass or plastic
- 8. Ring: Metal.
- 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
- 10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
- 11. Range for Fluids under Pressure: Two times operating pressure.
- C. Pressure-Gage Fittings:
  - 1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
  - 2. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porousmetal disc of material suitable for system fluid and working pressure.

#### 2.4 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flow Design, Inc.
  - 2. Trerice, H. O. Co.
  - 3. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- D. Core Inserts: One or two self-sealing rubber valves.
  - 1. Insert material for air, water, oil, or gas service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
  - 2. Insert material for air or water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.

## PART 3 - EXECUTION

#### 3.1 THERMOMETER APPLICATIONS

- A. Install direct-mounting, vapor-actuated dial thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic coil in air-handling units.
  - 2. Where shown on drawings.
- B. Install liquid-filled-case-type, vapor actuated dial thermometers at discharge of each pump.
- C. Provide the following temperature ranges for thermometers:
  - 1. Condenser Water: 0 to 100 deg. F, with 2-degree scale divisions.

# 3.2 GAGE APPLICATIONS

A. Install liquid-filled-case-type pressure gages at suction and discharge of each pump and where shown on drawings.

#### 3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- D. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- E. Install test plugs in tees in piping.

#### 3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

# 3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Bronze lift check valves.
  - 3. Bronze swing check valves.
  - 4. Iron swing check valves.
  - 5. Iron, single flange butterfly valves.
- B. Related Sections:
  - 1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

## 1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Set butterfly valves closed or slightly open.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

## 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 (DN150) and smaller.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: With extended neck.

- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
- G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Crane
    - c. Hammond Valve
  - 2. Description
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig (1035 kPa).
    - c. CWP Rating: 600 psig (4140 kPa).
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.

# 2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. DeZurik Water Controls.
    - 2. Description:
      - a. Standard: MSS SP-67, Type I.
      - b. CWP Rating: 150 psig (1035 kPa).
      - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
      - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
      - e. Seat: EPDM.
      - f. Stem: One- or two-pieces stainless steel.
      - g. Disc: Aluminum bronze.

### 2.4 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.

# 2.5 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Hammond Valve.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: flanged.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

# 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Lift Check Valves: With stem upright and plumb.

# 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

## 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball and butterfly valves.
  - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 3. Throttling Service except Steam: Ball or butterfly valves.
  - 4. Pump-Discharge Check Valves:
    - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 (DN 65) and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal-seat check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solderjoint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

- 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
- 6. For Grooved-End Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

# 3.5 GEOTHERMAL WATER PIPING

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Ball Valves: Two piece, regular port, bronze with bronze trim.
  - 2. Bronze Swing Check Valves: Class 125, bronze disc
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
  - 1. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 CWP, EPDM seat, aluminum-bronze disc.
  - 2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 175, 300 CWP.
  - 3. Iron Swing Check Valves: Class 125, metal seats. Iron, Grooved-End Check Valves, NPS 3 to NPS 12 (DN 80 to DN 300): 300 CWP.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fireprotection piping.
  - 3. Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
  - 4. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

## 1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
  - 1. AAA Technology & Specialties Co., Inc.
  - 2. B-Line Systems, Inc.; a division of Cooper Industries.
  - 3. Carpenter & Paterson, Inc.
  - 4. Empire Industries, Inc.
  - 5. ERICO/Michigan Hanger Co.
  - 6. Globe Pipe Hanger Products, Inc.
  - 7. Grinnell Corp.
  - 8. GS Metals Corp.
  - 9. National Pipe Hanger Corporation.
  - 10. PHD Manufacturing, Inc.
  - 11. PHS Industries, Inc.
  - 12. Piping Technology & Products, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

## 2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

## 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. GS Metals Corp.
  - 4. Power-Strut Div.; Tyco International, Ltd.
  - 5. Thomas & Betts Corporation.
  - 6. Tolco Inc.
  - 7. Unistrut Corp.; Tyco International, Ltd.

### 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.

- c. Masterset Fastening Systems, Inc.
- d. MKT Fastening, LLC.
- e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated, stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosionresistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
  - 1. Manufacturers:
    - a. ERICO/Michigan Hanger Co.
    - b. MIRO Industries.
- C. Low-Type, Single-Pipe Stand: One-piece plastic, stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
  - 1. Manufacturers:
    - a. MIRO Industries.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 1. Manufacturers:
    - a. ERICO/Michigan Hanger Co.
    - b. MIRO Industries.
    - c. Portable Pipe Hangers.
  - 2. Base: Plastic, Stainless steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuousthread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support.

- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 1. Available Manufacturers:
    - a. Portable Pipe Hangers.
  - 2. Bases: One or more plastic.
  - 3. Vertical Members: Two or more protective-coated-steel channels.
  - 4. Horizontal Member: Protective-coated-steel channel.
  - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structuralsteel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

### 2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

#### 2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

#### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.

- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
  - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
  - 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
  - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
  - 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  - 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  - Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
  - 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  - 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  - 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
  - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
  - 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  - 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  - 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  - 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

## 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

- 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- H. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- P. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
- 5. Insert Material: Length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

## 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

A. This Section includes the following:1. Restraining braces and cables.

# 1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Restraint Loading:
  - 1. Site class as defined in the IBC: C.
  - 2. Assigned Seismic use Group or Building Risk Category as defined in the IBC: III
  - 3. Seismic Design Category: D.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
    - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic and Wind-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    - c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
    - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- C. Qualification Data: For professional engineer and testing agency.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

# PART 2 - PRODUCTS

# 2.1 VIBRATION ISOLATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Ace Mountings Co., Inc.
  - 2. Amber/Booth Company, Inc.
  - 3. California Dynamics Corporation.
  - 4. Isolation Technology, Inc.
  - 5. Kinetics Noise Control.
  - 6. Mason Industries.
  - 7. Vibration Eliminator Co., Inc.
  - 8. Vibration Isolation.
  - 9. Vibration Mountings & Controls, Inc.

# 2.2 SEISMIC-RESTRAINT DEVICES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Amber/Booth Company, Inc.
  - 2. California Dynamics Corporation.
  - 3. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 4. Hilti, Inc.
  - 5. Kinetics Noise Control.
  - 6. Loos & Co.; Cableware Division.
  - 7. Mason Industries.
  - 8. TOLCO Incorporated; a brand of NIBCO INC.
  - 9. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

- C. Restraint Cables: ASTM A 603 galvanized, ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections, Reinforcing steel angle clamped to hanger rod.
- E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

# 2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel or powder coat for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

## 3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
  - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
  - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
  - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Piping Restraints:
  - 1. Comply with requirements in MSS SP-127.
  - 2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  - 3. Brace a change of direction longer than 12 feet (3.7 m).
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD, an agency acceptable to authorities having jurisdiction providing required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

- I. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

# 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Hydronic Piping" for piping flexible connections.

# 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage, Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. Verify snubber minimum clearances.
  - 9. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

- 10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
- 11. Test and adjust air-mounting system controls and safeties.
- 12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

# 3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

# 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration And Training."

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.

#### 1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch (0.8-mm), Stainless steel, 0.025-inch (0.64-mm), Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  - 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:

- 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- 2. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- 4. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 5. Fasteners: Stainless-steel rivets or self-tapping screws.
- 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number.

# 2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

## 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
  - 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

## 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Air Systems:
    - a. Constant-volume air systems.
    - b. Variable volume air systems.
  - 2. Hydronic Piping Systems:
    - a. Constant-flow systems.
    - b. Variable-flow systems.
  - 3. HVAC equipment quantitative-performance settings.
  - 4. Verifying that automatic control devices are functioning properly.
  - 5. Reporting results of activities and procedures specified in this Section.
  - 6. Domestic hot water return system.

#### 1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- E. NC: Noise criteria.
- F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- G. RC: Room criteria.

- H. Report Forms: Test data sheets for recording test data in logical order.
- I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.
- J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.
- K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.
- L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- P. TAB: Testing, adjusting, and balancing.
- Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- R. Test: A procedure to determine quantitative performance of systems or equipment.
- S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

## 1.4 SUBMITTALS

- A. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- B. Warranties specified in this Section.

## 1.5 ACTION SUBMITTALS

- A. LEED Submittals:
  - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASMRAE 62.1, Section 7.2.2 "Air Balancing".
  - 2. TAB Report for Prerequisite EA2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section .7.2.3 "System Balancing".

### 1.6 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or TAB firm's forms approved by Architect.
- D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
  - 1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing".
- G. ASHRAE/IESNA Compliance requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing".

#### 1.7 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### 1.8 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

### 1.9 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- 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. Contract Documents are defined in the General and Supplementary Conditions of Contract.
  - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flowcontrol devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under

conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units to verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers for clean screens and proper perforations.
- M. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine system pumps to ensure absence of entrained air in the suction piping.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.

R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

## 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

## 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

## 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

# 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
  - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fanmotor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

- 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
  - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
- 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

## 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Perform testing and balancing procedures on each system according to the procedures contained in AANC's "National Standards for Total System Balance" or ASHRAE 111 or SMACNA's "HVAC Systems Testing, Adjusting and Balancing" and in this section.
- B. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- C. Prepare schematic diagrams of systems' "as-built" piping layouts.
- D. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check expansion tank liquid level.
  - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
  - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
  - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 6. Set system controls so automatic valves are wide open to heat exchangers.
  - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

## 3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.
  - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

## 3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

## 3.9 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer, model, and serial numbers.

- 2. Motor horsepower rating.
- 3. Motor rpm.
- 4. Efficiency rating.
- 5. Nameplate and measured voltage, each phase.
- 6. Nameplate and measured amperage, each phase.
- 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.10 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Water Coils: Measure the following data for each coil:
  - 1. Entering- and leaving-water temperature.
  - 2. Water flow rate.
  - 3. Water pressure drop.
  - 4. Dry-bulb temperature of entering and leaving air.
  - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
  - 6. Airflow.
  - 7. Air pressure drop.

### 3.11 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

## 3.12 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

## 3.13 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
  - 2. Air Outlets and Inlets: 0 to minus 10 percent.
  - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
  - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

#### 3.14 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.15 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.

- 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB firm who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer, type size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outside, supply, return, and exhaust airflows.
  - 2. Water and steam flow rates.
  - 3. Duct, outlet, and inlet sizes.
  - 4. Pipe and valve sizes and locations.
  - 5. Terminal units.
  - 6. Balancing stations.
  - 7. Position of balancing devices.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
  - 1. Unit Data: Include the following:
    - a. Unit identification.

- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches (mm), and bore.
- i. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
- j. Number of belts, make, and size.
- k. Number of filters, type, and size.
- 2. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm (L/s).
  - b. Total system static pressure in inches wg (Pa).
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg (Pa).
  - e. Filter static-pressure differential in inches wg (Pa).
  - f. Preheat coil static-pressure differential in inches wg (Pa).
  - g. Cooling coil static-pressure differential in inches wg (Pa).
  - h. Heating coil static-pressure differential in inches wg (Pa).
  - i. Outside airflow in cfm (L/s).
  - j. Return airflow in cfm (L/s).
  - k. Outside-air damper position.
  - I. Return-air damper position.
  - m. Vortex damper position.
- G. Apparatus-Coil Test Reports:
  - 1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch (mm) o.c.
    - f. Make and model number.
    - g. Face area in sq. ft. (sq. m).
    - h. Tube size in NPS (DN).
    - i. Tube and fin materials.
    - j. Circuiting arrangement.
  - 2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm (L/s).
    - b. Average face velocity in fpm (m/s).
    - c. Air pressure drop in inches wg (Pa).
    - d. Outside-air, wet- and dry-bulb temperatures in deg F (deg C).
    - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
    - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
    - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
    - h. Water flow rate in gpm (L/s).
    - i. Water pressure differential in feet of head or psig (kPa).
    - j. Entering-water temperature in deg F (deg C).
- k. Leaving-water temperature in deg F (deg C).
- I. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig (kPa).
- n. Refrigerant suction temperature in deg F (deg C).
- o. Inlet steam pressure in psig (kPa).
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  - 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches (mm), and bore.
    - h. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
  - 2. Motor Data:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches (mm), and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches (mm).
    - g. Number of belts, make, and size.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm (L/s).
    - b. Total system static pressure in inches wg (Pa).
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg (Pa).
    - e. Suction static pressure in inches wg (Pa).
- I. Air-Terminal-Device Reports:
  - 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Test apparatus used.
    - d. Area served.
    - e. Air-terminal-device make.
    - f. Air-terminal-device number from system diagram.
    - g. Air-terminal-device type and model number.
    - h. Air-terminal-device size.
    - i. Air-terminal-device effective area in sq. ft. (sq. m).
  - 2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm (L/s).

- b. Air velocity in fpm (m/s).
- c. Preliminary airflow rate as needed in cfm (L/s).
- d. Preliminary velocity as needed in fpm (m/s).
- e. Final airflow rate in cfm (L/s).
- f. Final velocity in fpm (m/s).
- g. Space temperature in deg F (deg C).
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
  - 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  - 2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm (L/s).
    - b. Entering-water temperature in deg F (deg C).
    - c. Leaving-water temperature in deg F (deg C).
    - d. Water pressure drop in feet of head or psig (kPa).
    - e. Entering-air temperature in deg F (deg C).
    - f. Leaving-air temperature in deg F (deg C).
- K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
  - 1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model and serial numbers.
    - f. Water flow rate in gpm (L/s).
    - g. Water pressure differential in feet of head or psig (kPa).
    - h. Required net positive suction head in feet of head or psig (kPa).
    - i. Pump rpm.
    - j. Impeller diameter in inches (mm).
    - k. Motor make and frame size.
    - I. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. Full-load amperage and service factor.
    - p. Seal type.
  - 2. Test Data (Indicated and Actual Values):
    - a. Static head in feet of head or psig (kPa).
    - b. Pump shutoff pressure in feet of head or psig (kPa).
    - c. Actual impeller size in inches (mm).
    - d. Full-open flow rate in gpm (L/s).

- e. Full-open pressure in feet of head or psig (kPa).
- f. Final discharge pressure in feet of head or psig (kPa).
- g. Final suction pressure in feet of head or psig (kPa).
- h. Final total pressure in feet of head or psig (kPa).
- i. Final water flow rate in gpm (L/s).
- j. Voltage at each connection.
- k. Amperage for each phase.
- L. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

## 3.16 INSPECTIONS

- A. Initial Inspection:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
  - 2. Randomly check the following for each system:
    - a. Measure airflow of at least 10 percent of air outlets.
    - b. Measure water flow of at least 5 percent of terminals.
    - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    - d. Measure sound levels at two locations.
    - e. Measure space pressure of at least 10 percent of locations.
    - f. Verify that balancing devices are marked with final balance position.
    - g. Note deviations to the Contract Documents in the Final Report.

## 3.17 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

DIVISION 230593 - HVAC - Testing, Adjusting, and Balancing (TAB) Guideline

PART 1 – GENERAL

- 1.01 RELATED DOCUMENTS
  - A. All Division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.
- 1.02 SCOPE OF WORK
  - A. The Division of Engineering and Contract Administration will directly contract with a certified testing, adjusting, and balancing contractor ("TAB Agency") to test, adjust, and balance the HVAC systems.
  - B. This specification section is included herein to assist and inform the Contractor of the standards, requirements and scope of the work to be performed by the Commonwealth's TAB Agency.
- 1.03 PREPARATION AND COORDINATION REQUIREMENTS GENERAL
  - A. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB Agency no later than 30 days prior to the start of TAB work.
  - B. System installation and equipment startup shall be complete prior to the TAB Agency's being notified to begin.
  - C. The building control system shall be complete and operational. The Building Control system (sub)contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
  - D. All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
  - E. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

### 1.04 PREPARATION AND COORDINATION REQUIREMENTS – HVAC CONTROLS

- A. Written notice shall be submitted through the General Contractor to the Architect-Engineer stating that the Control System is operating and controlling the HVAC System. This letter is to be provided to the DECA Project Manager and the TAB Agency prior to any balancing.
- B. The Contractor/Control (sub)contractor shall have entered all data needed for the TAB Agency to begin work.
- C. The Contractor/Control (sub)contractor shall be available to correct any problems that the TAB Agency may encounter with the systems.
- D. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for HVAC controls.
- 1.05 PREPARATION AND COORDINATION REQUIREMENTS MECHANICAL
  - E. Written notice shall be submitted through the General Contractor to the Architect stating that the HVAC system is operational and ready for the TAB Agency. This letter is to be provided to the DECA Project Manager and the TAB Agency prior to any balancing.
  - A. The Contractor/Mechanical subcontractor shall have proved all units operational and all air outlets in the full open position.
  - B. The Contractor/Mechanical subcontractor shall be available to correct any problems that the TAB Agency might have with any equipment or systems.

- C. The Contractor/Mechanical subcontractor shall furnish and install any replacement sheaves, pulleys and drive belts required for flow adjustments, as determined by the TAB Agency. Adjustable sheaves shall be selected so that the final adjustment position is in the middle third of the total adjustment range.
- D. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for mechanical work.

# 1.06 PREPARATION AND COORDINATION REQUIREMENTS – DUCTWORK

- A. Ductwork air leakage testing shall be performed by the TAB Agency.
- B. The ductwork/sheetmetal subcontractor shall promptly correct any related problems discovered by the leakage tests.
- C. All costs associated with retesting and/or delays or other problems which impede the TAB Agency from performing such testing shall be paid by the contractor and any subcontractor(s) for ductwork.

## 1.07 WORK BY TAB AGENCY

- A. The work included in the remainder of this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. This work shall be performed by the TAB Agency under direct contract to the owner. The remainder herein is also for the information of the Contractor and all subcontractors.
- B. The items requiring testing, adjusting, and balancing include the following:

AIR SYSTEMS:

Supply Fan AHU Return Fans Relief Fans Exhaust Fans Zone branch and main ducts Diffusers, Registers and Grilles Coils (Air Temperatures) Heat Pumps

HYDRONIC SYSTEMS:

Pumps System Mains and Branches Heat pumps Coils

## 1.08 QUALIFICATIONS

- A. Agency qualifications: The TAB Agency shall be a current member of a nationally recognized balance organization ("National Organization"). This Organization shall provide the owner with National Guarantee document certifying the work of the TAB Agency. Acceptable organizations are Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
  - 1. The selected TAB Agency must provide proof of certification for the total project (air, water, sound, vibration, etc.).
  - 2. The selected TAB Agency shall be provided access to computers, cables or any software needed to operate the building control system during the balancing phase.
- A. All work shall be in accordance with the latest edition of the National Standards, as published by the National Organization affiliated with the TAB Agency.

# 1.09 SUBMITTALS

- A. Qualifications: The TAB Agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's test and balance engineer (TBE) certificate. Certification in noise, vibration, and air quality shall be submitted as the job requires. At minimum, the balance technician shall possess their technician certification.
- B. Procedures and agenda: The TAB Agency shall submit the TAB procedures and agenda proposed to be used.

### 1.10 REPORTS

A. Final TAB Report – The TAB Agency shall submit the final TAB report for review by the engineer. All equipment including but not limited to fans, outlets, traverses, static pressure profiles, pumps, coils, etc. shall be identified in the report. The report must also include, at minimum, electronic drawings that correspond to all test points for additional report clarification. The TAB Agency shall submit an "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and National Standards.

Submit three (3) electronic copies of the Final TAB Report to the Architect-Engineer, and (1) electronic copy to the Project Manager from the Division of Engineering and Contract Administration. A maximum of three (3) additional hard copies shall be submitted on request.

Payments for the TAB work shall be contingent upon the proper submittal and approval of the TAB reports.

### 1.11 DEFICIENCIES

- A. Any deficiencies in the installation or performance of a system or component observed by the TAB Agency shall be brought to the attention of the appropriate responsible person. Also notify the mechanical project representative from the Division of Engineering and Contract Administration.
- B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

## PART 2 – INSTRUMENTATION

A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of the National Standards.

### PART 3 – EXECUTION

### 3.01 GENERAL

- A. The specific systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with national Standards. Adjustment tolerances shall be + or – 10% unless otherwise stated.
- B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
- C. All information necessary to complete a proper TAB project and report shall be per National Organization's standards unless otherwise noted. The descriptions for work required, as listed in this section, are guides to the minimum information needed.

# 3.02 AIR SYSTEMS

A. The TAB Agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. The TAB Agency shall perform the following TAB procedures in accordance with the National Standards:

For supply fans:

- 1. Fan speeds Test and adjust fan RPM to achieve maximum or design CFM. Confirm proper rotation direction.
- 2. Current and Voltage Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
- 3. Pitot-Tube Traverse Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.
- 4. Outside Air Test and adjust the outside air on applicable equipment using a Pitottube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees Fahrenheit or use the difference between Pitot-tube traverses of the supply and return air ducts.
- 5. Static Pressure Test and record system static profile of each supply fan.

For return fans:

- 1. Fan speeds test and adjust fan RPM to achieve maximum or design CFM. Confirm proper rotation direction.
- 2. Current and Voltage Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
- 3. Pitot-Tube Traverse Perform a Pitot-tube traverse of the main return ducts to obtain total CFM.
- 4. Static Pressure Test and record system static profile of each return fan.

For relief fans:

- 1. Fan speeds Test and adjust fan RPM to achieve maximum or design CFM. Confirm proper rotation direction.
- 2. Current and Voltage Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
- 3. Static Pressure Test and record system static profile of each relief fan.
- 4. Pitot Tube Traverse If possible, per system ductwork, perform a traverse to determine Relief Air CFM.

For exhaust fans:

- 1. Fan speeds Test and adjust fan RPM to achieve maximum and design CFM. Confirm proper rotation direction.
- 2. Current and Voltage Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
- 3. Pitot-tube Traverse Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM.

For zone, branch and main ducts:

1. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

For diffusers, registers and grilles:

- 1. Tolerances Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts.
- 2. Identification Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

For coils:

1. Air Temperature – Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

### 3.03 HYDRONIC SYSTEMS

A. The TAB Agency shall, as applicable, confirm that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB Agency shall perform the following testing and balancing functions in accordance with the National Standards:

For pumps:

- 1. Test and adjust chilled water, hot water, and condenser water pumps to achieve maximum or design GPM. Check pumps for proper operation. Confirm proper rotation direction. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.
- Current and Voltage Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

For system mains and branches:

1. Adjust water flow in pipes to achieve maximum or design GPM.

For coils:

- 1. Tolerances Test, adjust, and balance all chilled-water and hot-water coils within 10% of design requirements.
- 2. Verification Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.
- 3. All automatic flow control devices shall be measured for correct differential pressure and flow. Each devices shall be included in the report with the appropriate information.

# 3.04 OPTIONAL TAB SERVICES-----

A. Preconstruction Plan Check and Review:

The TAB Agency shall review the project documents and contractor submittals for their effect on the TAB process and overall performance of the HVAC system. It shall submit recommendations for enhancements or changes to the system within 30 days of document review.

B. Job Site Inspections:

During construction, the TAB Agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times. (Typically, these are performed when 60% of the total system is installed and again when 90% of the total system is installed, prior to insulation of the duct and piping). The TAB Agency shall submit a written report of each inspection.

C. Duct Leakage Testing:

The installing contractor shall isolate and seal sections of ductwork for testing. The test pressures required and the amount of duct to be tested shall be described by the engineer in

the appropriate duct classification section. All testing shall be based on one test per section only unless otherwise noted.

D. Temperature Testing:

To verify system control and operation, a series of three temperature tests shall be taken at approximately two-hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods. (Random zones my be selected by the Engineer if such a test is needed to prove building system.)

E. Kitchen Hood Testing:

The TAB Agency shall test and adjust kitchen hood total airflow by duct Pitot-tube traverse or best possible method, if applicable under local code. All sealing of test holes in the exhaust duct to be by others per local code requirements. The TAB Agency shall test and record face velocities in accordance with design requirements. It shall test and adjust makeup airflow (if included) to meet design face velocities and pressurization and to minimize turbulence.

F. Building/Zone Pressurization:

The TAB Agency shall test and adjust building/zone pressurization by setting the design flows to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow, and gradually reduce and exhaust air rate to obtain the required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and gradually increase the exhaust air rate to obtain the required flow or pressure difference.

G. TAB Verification

The TAB Agency is to include time to verify a minimum of 10% of all readings or maximum of 1 day.

END OF SECTION

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Tapes.
  - 8. Securements.
- B. Related Sections:
  - 1. Division 22 Section "Plumbing Insulation."

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

### 1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

### 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Duct Wrap.

- b. Johns Manville; Microlite.
- c. Knauf Insulation; Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; All-Service Duct Wrap.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 3. Type II, 1200 deg F (649 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F (10 to 427 deg C).
  - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-97.
- b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
- c. Marathon Industries, Inc.; 290.
- d. Mon-Eco Industries, Inc.; 22-30.
- e. Vimasco Corporation; 760.

### 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 5. Color: White.

### 2.5 SEALANTS

- A. FSK Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-76-8.
    - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Vimasco Corporation; 750.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
  - 5. Color: Aluminum.
- B. ASJ Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-76.

- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- 5. Color: White.

# 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

# 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches (75 mm).
  - 3. Thickness: 11.5 mils (0.29 mm).
  - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches (75 mm).
  - 3. Thickness: 6.5 mils (0.16 mm).
  - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

## 2.8 SECUREMENTS

- A. Bands:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products; Bands.
    - b. PABCO Metals Corporation; Bands.
    - c. RPR Products, Inc.; Bands.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.
  - 3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.
  - 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
  - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) or 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; CD.
      - 3) Midwest Fasteners, Inc.; CD.
      - 4) Nelson Stud Welding; TPA, TPC, and TPS.
  - Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) or 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38mm) galvanized carbon-steel washer.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; Cupped Head Weld Pin.
      - 3) Midwest Fasteners, Inc.; Cupped Head.
      - 4) Nelson Stud Welding; CHP.
  - 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      - 2) GEMCO; Perforated Base.
      - 3) Midwest Fasteners, Inc.; Spindle.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
- c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.
    - b. Childers Products.
    - c. PABCO Metals Corporation.
    - d. RPR Products, Inc.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

# 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

- 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
  - a. For below ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

- 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
- 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
  - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
  - 2. Pipe: Install insulation continuously through floor penetrations.
  - 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating

cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
  - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  - 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

# 3.6 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

- 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
- 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.

- e. Impale insulation over pins and attach speed washers.
- f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).
- Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
- 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
- 8. Insulate over duct mounted smoke detectors in supply ductwork. Cut insulation on three sides of smoke detector to allow inspection. Label or stencil "Smoke Detector" on insulation.

## 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- 3.8 DUCT INSULATION SCHEDULE, GENERAL
  - A. Plenums and Ducts Requiring Insulation:
    - 1. Indoor, concealed and exposed supply, all ventilation supply, all outdoor air intake ductwork, and all return air ductwork.
  - B. Items Not Insulated:
    - 1. Exhaust Air Ductwork.
    - 2. Factory insulated flex ducts.
    - 3. Factory insulated plenums and casings.
    - 4. Flexible connectors.

- 5. Vibration-control devices.
- 6. Factory-insulated access panels and doors.

# 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. All supply, all ventilation supply, all supply duct from AHU-1 to air terminal units, all outside air intake duct and all return air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

## 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

# 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 deg. F (16 deg. C):
  - All Pipe Sizes: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: <sup>1</sup>/<sub>2</sub> inch (13 mm).
- B. Geothermal Water Piping Supply and Return:
  - 1. NPS 6 and Smaller: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe4, Type I: 1 inch thick.

END OF SECTION 230700

1.

SECTION 230716 - HVAC EQUIPMENT INSULATION

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
  - 1. Dual temperature-water pumps.
  - 2. Air separators.
- B. Related Sections:
  - 1. Section 230700 "HVAC Insulation."

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Laboratory Test Reports: For sealants, indicating compliance with requirements for lowemitting materials.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.
- C. Coordinate installation and testing of heat tracing.

### 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Sheet and K-FLEX LS.

# 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H .B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.

# 2.4 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

# 2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches (75 mm).
  - 3. Thickness: 11.5 mils (0.29 mm).
  - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

# 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
  - 1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
  - 2. Seal longitudinal seams and end joints.

# 3.5 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

# 3.6 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Geothermal Water pump insulation shall be the following:
  1. Flexible Elastomeric: 1 inch (25 mm) thick.
- D. Air separator for geothermal system insulation shall be the following:
  - 1. Flexible Elastomeric: 1 inch (25 mm) thick.

END OF SECTION 230716

# SECTION 230900 – BUILDING MANAGEMENT SYSTEM

Tracer ES Direct Digital Control Systems

# PART 1 - GENERAL

- 1.0 SECTION INCLUDES
  - .1 General Description
  - .2 Submittals
  - .3 Architecture/Communication
  - .4 Operator Interface
  - .5 Application and Control Software
  - .6 System Controllers
  - .7 Equipment Controllers
  - .8 Input/Output Modules
  - .9 Auxiliary Control Devices
  - .10 System Tools
  - .11 Warranty and Maintenance

# 1.1 GENERAL DESCRIPTION

- A. The Building Automation System (BAS) shall be Alerton, Reliable Controls or Trane and consists of a web-based, high-speed peer-to-peer network of Building Controllers residing on an owner provided Local Area Network (LAN) based on ISO 8802-3 (Ethernet) Physical/Data Link layer protocol. This is the same LAN that the existing BAS Central Server and workstations resides on. Building Controllers shall communicate via Annex J of ANSI / ASHRAE™ Standard 135-2004.
- B. The new Building Automation Systems (BAS) must integrate seamlessly into the existing Trane Tracer ES BAS utilizing Annex J of ASHRAE Standard 135-2004 (BACnet). This integration must include all software licenses, graphics, programming, and data bases while providing full functionality from the Trane Tracer ES system. Graphics must duplicate the existing graphics in form and functionality. The object oriented database for the new system shall adhere to the existing system's naming convention.
- C. The BAS shall provide a web-based Graphical User Interface (GUI) and be designed to integrate multiple BACnet-based systems, collect, store and display historical data, and provide enterprise-wide or multiple building facilities management capabilities from a central database. The entire system shall be navigable by customer graphics created by the BAS contractor for each of the buildings in the enterprise system.
- D. The existing Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database already running the enterprise system will be reused.
- E. The BAS Contractor shall work with the owner's IT department to secure the appropriate system hardware, software, licenses, network drops, and addresses necessary to complete the addition of this project to the existing system.
- F. 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 or subcontracted by the BAS Contactor. The BAS Contractor shall have a minimum rated qualification of 10 years of installation experience with the controls manufacturer and shall provide documentation in the submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the BAS

Contractor. The BAS Contractor shall have an in place a support facility within 100 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

- 1. System Installer Qualifications
  - a. The System Installer shall have an established working relationship with the BAS contractor of not less than ten years.
  - b. The System Installer must be trained and certified by the BAS Contractor as to their ability perform all necessary duties required for the proper installation of the controls equipment and wiring. The System Installer shall present for review the certification of completed training, including the hours of instruction upon request.
  - c. The installer shall have an office within 100 miles of the project site and provide 24-hour response in the event of a customer call.
- G. The BAS Contractor shall furnish all labor, materials, system engineering, programming, and service necessary for a complete and operating temperature control system as described. Equipment and labor not specifically referred to herein or on the plans, that is required to meet the functional intent, shall be provided without additional cost to the owner.

## 1.2 SUBMITTALS

- A. The BAS Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats.
- B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.
- C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- D. Submit the following within 30 days of contract award:
  - 1. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
  - 2. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets 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 drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
    - a. Centralized server hardware and software
    - b. Building Controllers
    - c. Custom Application Controllers
    - d. Application Specific Controllers
    - e. Operator Interface Computer(s) as specified
    - f. Configuration and service software programs
    - g. Portable Operator Workstation(s) or Service software PCs as specified
    - h. Auxiliary Control Devices
    - i. Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling
    - j. Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled

- k. Points list showing all system objects, and the proposed English language object names
- I. Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project
- m. Provide a BACnet Product Implementation Conformance Statement (PICS) for each BACnet device type in the submittal
- n. Color prints of proposed graphics with a list of points for display
- E. Project Record Documents. Upon completion of installation submit three (3) copies of record (asbuilt) documents. The documents shall be submitted for approval prior to final completion and include:
  - 1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.
  - 2. Testing and Commissioning Reports and Checklists.
  - 3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
    - a. Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
    - b. Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    - c. Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
    - d. Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware.
    - e. A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
    - f. One set of electronic media containing files of all color-graphic screens created for the project.
    - g. Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.
    - h. Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
    - i. Licenses and warranty documents for all equipment and systems.
    - j. Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

## 1.3 ARCHITECTURE/COMMUNICATION

- A. This project shall be comprised of a high speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall utilize BACnet MSTP (RS485) communications.
  - 1. The Owner will provide all communication media, connectors, repeaters, network switches, and routers necessary for the high speed Ethernet network. An active Ethernet port will be provided adjacent to each System Controller and operator interface (PC) for connection to this high speed Ethernet network.

2. All values within the system (i.e. schedules, datalogs, points, software variables, custom program variables) shall be readable and controllable (where appropriate) by any System Controller or BACnet Workstation on the communications network via BACnet.

# 1.4 OPERATOR INTERFACE

- A. Furnish 1 PC based operator interface as shown on the system drawings. Each of these operator interfaces shall be able to access all information in the system. The operator interface shall reside on the Enterprise wide network, which is same high-speed communications network as the System Controllers. The Enterprise wide network will be provided by the owner and supports the Internet Protocol (IP).
  - 1. Each PC based operator interface shall include the following:
    - a. Hardware type
      - 1) PC
      - 2) Laptop
    - b. Operating Systems
      - 1) Windows XP
      - 2) Windows 7
    - c. Minimum Hardware
      - 1) Pentium Core 2 DUO or better
      - 2) 4 GB RAM
      - 3) 100 GB hard drive space
      - 4) Internet Browser compatible with operator interface requirements outlined in the operator interface section
      - 5) Java Runtime Environment (JRE) V6.0 or higher
  - 2. Operator Interface
    - a. The operator interface shall be accessible via a web browser.
    - b. The operator interface shall support the following Internet web browsers:
      - 1) Internet Explorer 8.0+
      - 2) Firefox 4.0+
      - 3) Chrome 10.0+
    - c. The operator interface shall support the following mobile web browsers:
      - 1) iOS (iPad/iPhone) V4.0+
      - 2) Android (Tablet) V4.0+
      - 3) Android (Phone) V2.3+
    - d. System Security
      - 1) Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data.
      - 2) System security shall be selectable for each operator.
      - 3) The system supervisor shall have the ability to set security levels for all other operators.
      - 4) Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object.
      - 5) Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected for a defined period of time.
      - 6) All system security data shall be stored in an encrypted format.
      - 7) There is no limit to the number of password-protected users allowed in the system.
      - 8) The system should also support flexible business rules for valid usernames and passwords.
      - 9) The system shall support state-of-the-art encryption between server and web browser.
      - 10) The enterprise system can optionally be configured to encrypt data between the client and server using SSL (128bit).
    - e. Database

- 1) Database Save. A system operator with the proper password clearance shall be able to archive the database on the designated operator interface PC.
- 2) Database Restore. The system operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
- f. On-Line Help and Training
  - 1) Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
  - 2) On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.
- g. System Diagnostics
  - 1) The system shall automatically monitor the operation of all network connections, building management panels, and controllers.
  - 2) The failure of any device shall be annunciated to the operators.
- h. Equipment & Application Pages
  - The operator interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
    - a) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:
      - (1) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
      - (2) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
- i. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.
  - 1) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point and-click navigation between zones or equipment, and to edit set points and other specified parameters.
  - Graphic imagery graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
  - 3) Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.
  - 4) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
  - 5) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).
- j. Custom Graphics
  - 1) The operator interface shall be capable of displaying custom graphics in order to convey the status of the facility to its operators.
  - 2) Graphical Navigation. The operator interface shall provide dynamic color graphics of building areas, systems and equipment.
  - 3) Graphical Data Visualization. The operator interface shall support dynamic points including analog and binary values, dynamic text, static text, and animation files.

- 4) Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as GIF and JPEG.
- k. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
- I. Manual Control and Override.
  - 1) Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
  - 2) Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
  - 3) Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
  - 4) Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
- m. Engineering Units
  - 1) Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system.
  - 2) Unit selection shall be able to be customized by locality to select the desired units for each measurement.
  - 3) Engineering units on this project shall be IP.
- 3. Scheduling. A user shall be able to perform the following tasks utilizing the operator interface:
  - a. Create a new schedule, defining the default values, events and membership.
  - b. Create exceptions to a schedule for any given day.
  - c. Apply an exception that spans a single day or multiple days.
  - d. View a schedule by day, week and month.
  - e. Exception schedules and holidays shall be shown clearly on the calendar.
  - f. Modify the schedule events, members and exceptions.
  - g. Global Scheduling Support
    - 1) Assign attributes for individual schedules in order to facilitate quick selection of similar schedules across multiple buildings.
    - 2) The system shall allow ability to make changes to weekly schedules of all schedules in the system through single edit action.
    - 3) Ability to apply an exception to any or all of the schedules in a system though a single edit action.
    - 4) Allow user to specify different events for each day of the week when applying exceptions to schedules.
    - 5) Allow user to enact an emergency schedule for any or all of the schedules in the system though a single click action.
- 4. Trend Logs
  - a. Trend Logs Definition.
    - 1) The operator interface shall allow a user with the appropriate security permissions to define a trend log for any data in the system.
    - 2) The operator interface shall allow a user to define any trend log options as described in the Application and Control Software section.
  - b. Trend Log Viewer.

- 1) The operator interface shall allow Trend Log data to be viewed and printed.
- 2) The operator interface shall allow a user to view trend log data in text-based (time stamp/value).
- 3) The operator shall be able to view the data collected by a trend log in a graphical chart in the operator interface.
- 4) Trend log viewing capabilities shall include the ability to show a minimum of 5 points on a chart.
- 5) Each data point trend line shall be displayed as a unique color.
- 6) The operator shall be able to specify the duration of historical data to view by scrolling and zooming.
- 7) The system shall provide a graphical trace display of the associated time stamp and value for any selected point along the x-axis.
- c. Export Trend Logs.
  - 1) The operator interface shall allow a user to export trend log data in CSV or PDF format for use by other industry standard word processing and spreadsheet packages.
- 5. Alarm/Event Notification
  - a. An operator shall be notified of new alarms/events as they occur while navigating through any part of the system via an alarm icon.
  - b. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any operator interface.
    - 1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
    - 2) Alarm/event messages shall use full language, easily recognized descriptors.
    - 3) An operator with the proper security level may acknowledge and clear alarms/events.
    - 4) All alarms/events that have not been cleared by the operator shall be stored by the central server in an alarm log database.
    - 5) Store alarm data in a standard format accessible to user-specified peer database/server.
    - 6) The alarm/event log shall include a comment field for each alarm/event that allows a user to add specific comments associated with any alarm.
    - 7) Provide a printer-friendly format for printing alarm logs.
    - 8) Ability to mass delete alarms based on filter criteria such as: alarm priority, date and time, alarm status, alarm source, and alarm type.
  - c. Alarm Processing.
    - 1) The operator shall be able to configure any object in the system to generate an alarm when transitioning in and out of a normal state.
- 6. Reports and Logs.
  - a. The operator interface shall provide a reporting package that allows the operator to select reports.
  - b. The operator interface shall provide the ability to schedule reports to run at specified intervals of time.
  - c. The operator interface shall allow a user to export reports and logs from the building controller in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Acceptable formats include:
    - 1) CSV, HTML, XML, PDF
  - d. Reports and logs shall be readily printed to the system printer.
  - e. Provide a means to list and access the last 10 reports viewed by the user.
  - f. The following standard reports shall be available without requiring a user to manually configure the report:
    - 1) All Points in Alarm Report: Provide an on demand report showing all current alarms.
- 2) All Points in Override Report: Provide an on demand report showing all overrides in effect.
- 3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
- 4) Points report: Provide a report that lists the current value of all points
- 7. VAV Air System. An operator shall be able to view and control (where applicable) the following parameters via the operator interface:
  - a. System Mode
  - b. System Occupancy
  - c. Ventilation (Outdoor air flow) setpoint
  - d. Ventilation (Outdoor air flow) status
  - e. Air Handler Static pressure setpoint
  - f. Air Handler Static pressure status
  - g. Air Handler occupancy status
  - h. Air Handler Supply air cooling and heating set points
  - i. Air Handler minimum, maximum and nominal static pressure setpoints
  - j. VAV box minimum and maximum flow
  - k. VAV box drive open and close overrides
  - I. VAV box occupancy status
  - m. VAV box Airflow to space
  - n. Average space temperature
  - o. Minimum space temperature
  - p. Maximum space temperature
- 8. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs at the same time that all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.
- 9. Custom Graphic Editor. Provide the tools to create, modify, and debug custom graphics. The operator shall be able to create, edit, and download custom graphics at the same time that all other system applications are operating. The system shall be fully operable while custom graphics are edited, compiled, and downloaded.

# 1.5 APPLICATION AND CONTROL SOFTWARE

- A. The central server shall provide the following applications within the system.
  - 1. Trend Log Application
    - a. The system shall automatically harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application.
    - b. The automatic trend logs shall monitor these parameters for a minimum of 30 days at 15 minute intervals. The automatic trend logs shall be user adjustable.
  - 2. Site Management
    - a. The system must allow for grouping of the many sites in an enterprise in a logical manner.
    - b. The system shall provide a search function to allow users to search for sites or groups of sites by name or partial names.
    - c. The system must provide the necessary means to add, remove, and manage site
  - 3. Automatic System Database Save and Restore.
    - a. The central server shall store on the hard disk backup tables of data including trends, alarms, custom settings and user profiles.
    - b. The data shall be backed up once a day.
    - c. This database shall be updated whenever a change is made in the system.
    - d. The storage of this data shall be automatic and not require operator intervention.
    - e. This capability is completed through SQL scheduled automated tasks for backup and only available in full SQL, and not SQL Express.

- 4. Manual Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database manually at any time.
- 5. System Configuration. The central server shall serve web pages as the interface for configuring the operator-level functions of the system. A user with proper security shall be able to configure the system to allow for future changes or additions.

# 1.6 BUILDING CONTROLLERS

- A. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
  - 1. The BAS shall be composed of one or more independent, standalone, microprocessor based Building Controllers to manage the global strategies described in System software section.
  - 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
  - 3. The controller shall provide a communications port for connection of the Portable Operators Terminal.
  - 4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
  - 5. Controllers that perform scheduling shall have a real time clock.
  - 6. Data shall be shared between networked Building Controllers.
  - 7. The Building Controller shall utilize industry recognized open standard protocols for communication to unit controllers.
  - 8. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
- B. Each Building Controller shall reside on the enterprise-wide network, which is same high-speed network as the central server and PC workstations. The enterprise-wide network will be provided by the owner and supports the Internet Protocol (IP). Local connections of the Building Controller shall be on ISO 8802-3 (Ethernet). Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.
- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at 32° F to 120° F.
- D. Memory. The Building Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- E. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.
- F.

# 1.7 EQUIPMENT CONTROLLERS

- A. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 1 year. The 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 5 years after completion of this contract.
- B. This project shall comprise of a network utilizing high-speed BACnet over IP communications between the Central Server, Building Controllers and the Operator PC Workstations
- C. LonTalk<sup>™</sup> and/or BACnet/mstp sub-networks shall be used for communications between Building Controllers, Custom Application Controllers and Application Specific Controllers. At the contractors discretion, Zigbee certified wireless communication is acceptable. The contractor assumes all responsibility for proper communication and will provide all necessary routers/repeaters to create a reliable wireless mesh network.
- D. Wireless equipment controllers and auxiliary control devices shall conform to:
  - 1. IEEE 802 .15 .4 radios to minimize risk of interference and maximize battery life, reliability and range.
  - 2. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft (762m) with less than 2% packet error rate.

- To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators on the zone sensor display or using LED's on nondisplay models.
- 4. Two-way communications shall be used between the wireless devices and receiver to allow channel switching based on varying channel traffic and signal strength.
- 5. The wireless zone sensor and receiver addresses shall be held in nonvolatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.
- 6. The wireless zone sensor and receiver shall be addressed using rotary switches with numerical indication to simplify and reduce installation time and minimize risk of incorrect addressing. Two position DIP switches are not acceptable.
- 7. Installation and replacement of failed sensors shall be accomplished automatically after power up
- 8. To allow local troubleshooting without specialized tools, error codes shall be displayed on the digital display through a blinking pattern on the non-display models. Error codes shall include: not associated, address to 000, improper software configuration, input voltage too high, or general sensor failure. Codes shall be indicated on inside of sensor back cover.
- 9. Wireless communication between terminal units shall carry a certification by ZigbeeTM Building Automation. The protocol shall utilize Zigbee PRO – Zigbee Automation Profile, ANSUASHRAE Standard 135-2008 Addendum q (BACnetTM/Zigbee).
- 10. Outpout Power shall be 100 mW.
- 11. Certifications shall include FCC CFR47 RADIO FREQUENCY DEVICES -
- E. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
  - 1. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 0° C to 50° C [32° F to 120° F].
  - 2. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° C to 70° C [-40° F to 158° F].
- F. A local operator interface shall be provided at building locations where specified in the sequence of operations or point list. The operator interface shall be provided for interrogating and editing data. A system security password shall be available to prevent unauthorized use of the keypad and display.
- G. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.
- H. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
- I. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

### 1.8 INPUT/OUTPUT MODULES

- A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.
- D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and also accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.

- E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- F. Binary outputs shall provide for on/off operation. Terminal unit and zone control applications may use 2 outputs for drive-open, drive-close (tri-state) modulating control.
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 mA signal as required to provide proper control of the output device.

# 1.9 AUXILIARY CONTROL DEVICES

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

- 1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
- 2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
- 3. Damper shaft bearings shall be as recommended by manufacturer for application.
- 4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
- 5. All leakage testing and pressure ratings will be based on AMCA Publication 500.
- 6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.
- C. Electric damper/valve actuators.
  - 1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
  - 2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
  - 3. All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
  - 4. Proportional actuators shall accept a 0-10 VDC or 0-20 mA control signal and provide a 2-10 VDC or 4-20 mA operating range.
  - 5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
  - 6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
  - 7. Actuators shall be Underwriters Laboratories Standard 873 listed.
  - 8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- D. Control Valves
  - 1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.
  - 2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
    - a. Water Valves:
      - 1) Two-way: 150% of total system (pump) head.
      - 2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
      - Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
      - 4) Sizing Criteria:
        - a) Two-position service: Line size.

- b) 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, whichever is greater.
- c) Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), [5] psi maximum.
- d) Valves 1/2" through 2" shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc, or stainless steel ball.
- e) 2-1/2" valves and larger shall be cast iron ANSI Class 125 with guided plug and Teflon packing.
- 5) Water valves shall fail normally open or closed as scheduled on plans or as follows:a) Heating coils in air handlers normally open.
  - b) Chilled water control valves normally closed.
  - c) Other applications as scheduled or as required by sequence of operation.
- 6) Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.
- b. Steam Valves:
  - 1) 150% of operating (inlet) pressure.
  - 2) Body and trim materials shall be per manufacturer's recommendations for design conditions and service. Linear ports for modulating service.
  - 3) Sizing Criteria:
    - a) Two-position service: pressure drop 10% to 20% of inlet psig.
    - b) Modulating service 15 psig or less: pressure drop 80% of inlet psig.
    - c) Modulating service 16 to 50 psig: pressure drop 50% of inlet psig.
    - d) Modulating service over 50 psig: pressure drop as scheduled on plans.
- E. Temperature Sensors
  - 1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
  - 2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5m [5 feet] in length.
  - 3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
  - 4. Space sensors shall be equipped with set-point adjustment, override switch, digital display, and/or communication port as shown on the drawings.
  - 5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1 C [0.2 F].
  - 6.
- F. Humidity Sensors
  - 1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of ±5% R.H.
  - 2. Duct sensors shall be provided with a sampling chamber.
  - 3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40° C to 75° C [-40° F to 170° F].
  - 4. Humidity sensor's drift shall not exceed 1% of full scale per year.
- G. Static Pressure Sensors
  - 1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.

- 2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
- 3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 mA output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
- 4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 mA output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.
- H. Low Limit Thermostats
  - 1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.
  - 2. Low limit shall be manual reset only.
- I. Carbon Dioxide (CO2) Sensors
  - 1. Carbon Dioxide sensors shall measure CO2 in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.
- J. Flow Switches
  - 1. Flow-proving switches shall be either paddle or differential pressure type, as shown.
  - Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified.
  - Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.
  - 4. Current sensing relays may be used for flow sensing or terminal devices.
- K. Relays
  - 1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
  - 2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.
- L. Transformers and Power Supplies
  - 1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
  - 2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
  - 3. Unit shall operate between 0° C and 50° C.
  - 4. Unit shall be UL recognized.
- M. Local Control Panels
  - 1. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.
  - 2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
  - 3. Provide on/off power switch with over-current protection for control power sources to each local panel.
  - 4.

# 1.10 SYSTEM TOOLS

A. BAS Operators : On-site instruction consisting of four (4) four hour (4) sessions shall be provided to completely familiarize operating personnel with the sequence of operations, digital controller software configurations, Object oriented database, Network Controller software configurations, system graphics and BAS network map.

# 1.11 WARRANTY AND MAINTENANCE

- A. All components, system software, and parts furnished and installed by the BAS Contractor shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion unless extended warranty by owner or mfg is greater than one year. Labor to repair, reprogram, or replace these components shall be furnished by the BAS Contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BAS Contractor shall be the responsibility of the trade contractor performing the installation. 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 forty-eight (48) hours standard working hours. Emergency service shall be available within twenty-four (24) hours.
- B. The BAS Contractor shall provide remote critical alarm monitoring and phone support for a period of one year. Upon receipt of critical alarms, the BAS Contractor shall remotely investigate the alarm and notify the owner of possible causes and solutions. The BAS Contractor shall also provide telephone support by a factory trained technician who has immediate access to all relevant documentation including operations and maintenance manuals and design drawings. Critical alarm monitoring and telephone support shall be provided between the hours of 8:00 am to 5:00 pm, Monday through Friday excluding Holidays.
- C. The BAS Contractor shall provide utility energy usage monitoring and reporting for a period of one year. All utility usage will be trended and a report issued on a quarterly basis. If there is an abnormal change in utility usage the owner will be notified within 72 hours and a report will be issued.

# 1.12 MISCELLANEOUS DEVICES

- A. Variable Frequency Motor Speed Control Drives:
  - 1. This specification is to cover a complete Variable Frequency Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
  - 2. Submittals
    - a. Product Data: For each type of VFD, provide dimensions, mounting arrangements, location for conduit entries, shipping and operating weights and manufacturer's technical data.
    - b. Shop Drawings: For each VFD, include dimensioned details, including required clearances and service space around equipment. For each VFD include complete wiring diagrams.
    - c. Operation and Maintenance Data (Users Manual): For each type of VFD, provide a manufacturer's O&M manual.
    - d. Compliance to IEEE 519 VFD manufacturer shall provide, if required, a harmonic analysis for this jobsite. Harmonic analysis shall include total harmonic voltage distortion (<5%) and total harmonic current distortion (TDD). All VFD's shall include a minimum of 5% impedance reactors, no exceptions. Any additional requirements above the 5% impedance as required from the harmonic analysis shall be provided at cost plus 15% markup.
  - 3. Quality Assurance

- a. Manufacturer Qualifications: Maintain, within 60 miles of Project site, a manufacturer certified service center capable of performing certified start up, commissioning, warranty service, training, parts, emergency maintenance and repairs.
- b. Source Limitations: Obtain VFD's of a single type through one source from a single manufacturer. All VFD's on the jobsite shall be furnished from one VFD manufacturer.
- c. VFD's must comply with the following standards: Standard 519-1992, IEEE Guide for Harmonic Content and Control, UL508C, and ICS 7.0, AC Adjustable Speed Drives.
- d. The VFD and all Electrical Components, Devices, and Accessories must be UL Listed and labeled.
- e. VFD's must have a documented MTBF (mean time between failures) rating of in excess of 200,000.
- 4. Manufacturers
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1. ABB, Model ACH 550
- 5. Variable Frequency Drives
  - a. Description: NEMA ICS 2, IGBT, PWM, VFD; UL listed and labeled as a complete unit and designed to provide variable speed of a NEMA MG 1, Design B, 3-phase, EPACT 92, standard three phase A.C. induction motor by adjusting output voltage and frequency.
  - b. Output Rating: 3-phase; 0 to 60 Hz, with voltage proportional to frequency throughout voltage range. Utilization of the volts/hz-squared output is preferable for energy savings.
  - c. Unit Operating Requirements:
    - 1. Input AC voltage tolerance of plus or minus 10 percent.
    - 2. Input frequency tolerance of 60 Hz, plus or minus 5 percent.
    - 3. Adjustable carrier frequency, from 4 to 8 kHz or have a dither, alternating carrier frequency.
    - 4. Minimum Efficiency: 96% at half speed, 98% at full speed.
    - 5. Minimum Displacement Primary-Side Power Factor: 98 percent.
    - 6. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds and 180% peak, fold back rating.
    - 8. Starting Torque: 180 percent of rated torque (auto start).
    - 9. Speed Regulation: Plus or minus 1 percent.
    - 10. Power loss ride through of 2 seconds.
    - 11. The VFD shall be capable of starting (FLYING START) into a coasting (rotating) load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage
    - 12. The VFD shall have the ability to automatically restart after an over-current, overvoltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
    - 13. Isolated control interface to follow control signal over a 40:1 speed range.
    - 14. VFD must meet the requirements for Radio Frequency Interference (RFI).
  - d. All VFDs shall have the following standard features:
    - All VFDs shall have the same customer interface. Each VFD shall have its own keypad (HMI).
    - 2. The keypad shall include Hand-Off-Auto selections and manual speed control.
    - 3. There shall be a built-in time clock in the VFD keypad.
    - 4. The VFDs shall utilize pre-programmed application macros.
    - 5. The VFD shall have cooling fans that are designed for easy replacement.

- 6. The VFD shall have an integral 5% impedance line reactors to reduce the harmonics.
- 7. The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition.
- e. Internal Adjustability Capabilities via keypad (HMI) supplied with each VFD:
  - 1. Three (3) programmable critical frequency lockout ranges (critical speed avoidance).
  - 2. Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using VFD for closed loop control.
  - 3. Two (2) programmable analog inputs shall accept current or voltage signals. (0-10 VDC or 0-20 or 4-20 ma) selectable
  - 4. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional signal for Output Frequency (Hz), Motor Speed (RPM), Output Voltage, Output Current (amps), Motor Torque and other data.
  - 5. Six (6) programmable digital inputs for interfacing with external devices.
  - 6. There shall be a run permissive circuit for damper or valve control (uses one of the DI).
  - 7. Three (3) programmable digital Form-C relay outputs. Outputs shall be true form C type contacts; open collector outputs are not acceptable
  - 8. Seven (7) programmable preset speeds.
  - 9. Two independently adjustable accel and decel ramps with 1 1800 seconds
  - 10. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.
  - 11. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.
  - 12. The VFD shall include password protection against parameter changes.
  - 13. Minimum Speed Adjustment: 0 to 95 percent of maximum rpm.
  - 14. Maximum Speed Adjustment: 5 to 100 percent of maximum rpm.
  - 15. Current Limit: 60 to 110 percent of nominal rating.
- f. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable).
- g. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alphanumeric codes are not acceptable):
  - 1. Output Frequency (hz)
  - 2. Setpoint speed (hz or rpm)
  - 3. Motor Speed (RPM, %, or Engineering units)
  - 4. Motor Current (amps)
  - 5. Calculated Motor Torque (%)
  - 6. Calculated Motor Power (kW)
  - 7. DC Bus Voltage
  - 8. Output Voltage (volts)
  - 9. Run time (run hours)
  - 10. KwH calculations
  - 11. DI Status (1/0)
  - 12. Analog Input Values (VDC or ma)
  - 13. Relay Status (1/0)

- 14. Analog Output Status (ma)
- 15. Last three faults with real time status (no codes--alpha numeric status)
- h. The VFD shall include a Fireman's override input. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. <u>"Override Mode"</u> shall be displayed on the keypad.
- i. Self-Protection and Reliability Features:
  - 1. Under and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
  - 2. Notch filter to prevent operation of the VFD-motor-load combination at a natural frequency.
  - 3. Instantaneous line-to-line and line-to-ground overcurrent trips.
  - 4. Loss-of-phase protection.
  - 5. Reverse-phase protection.
  - 6. Motor Overtemperature fault.
  - 7. Loss of signal protection with speed default of 80% (programmable) of the most recent signal.
- j. Status Indication: Door-mounted Keypad (HMI) shall indicate the following conditions:
  - 1. Power on and operating conditions
  - 2. Motor RPM (or % speed) and direction
  - 3. Fault Indication and enunciation of specific fault.
  - 4. Line Voltage (incoming voltage or DC bus voltage)
  - 5. Output voltage.
  - 6. Run or operating hours
  - 7. Control Location (local/remote or hand/auto)
- k. All VFDs shall include EMI/RFI filters (no exceptions).
- I. Serial Communications
  - The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. [Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available.] Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
  - The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
    - a. Data Sharing Read Property B.
    - b. Data Sharing Write Property B.
    - c. Device Management Dynamic Device Binding (Who-Is; I-Am).
    - d. Device Management Dynamic Object Binding (Who-Has; I-Have).
    - e. Device Management Communication Control B.
  - 3. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.

- 4. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
- 5. Serial communication in bypass shall include, but not be limited to; bypass runstop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.
- 6. The VFD / bypass shall allow the DDC to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the DDC system. This allows for remote monitoring of which (of up to 4) safeties are open.
- 7. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.
- m. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
- B. Local Control Panels
  - All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
  - 2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that

are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.

- 3. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
- 4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
- 5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
- 6. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.
- C. Power Supplies
  - 1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
  - 2. Input: 120 VAC +10%, 60Hz.
  - 3. Output: 24 VDC.
  - 4. Line Regulation: +0.05% for 10% line change.
  - 5. Load Regulation: +0.05% for 50% load change.
  - 6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
  - 7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
  - 8. A power disconnect switch shall be provided next to the power supply.
- D. Thermostats
  - 1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

# 1.13 ENCLOSURES

- A. The VFD package as specified herein shall be enclosed in a UL Listed Type 12 Enclosure completely assembled and tested by the manufacturer in an ISO900 1 facility. Enclosure shall be UL listed as a plenum rated VFD.
  - 1. UL Type 12 (NEMA 12 / IP 54) enclosure. This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.
- 1.14 OPTIONAL FEATURES OPTIONAL FEATURES TO BE FURNSIHED AND MOUNTED BY THE DRIVE MANUFACTURER. ALL OPTIONAL FEATURES SHALL BE UL LISTED BY THE DRIVE MANUFACTURER AS A COMPLETE ASSEMBLY AND CARRY A UL 508 LABEL
  - A. A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor per section 2.5 below.
  - B. Door interlocked, padlockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Disconnect option shall be available with or without systems requiring bypass.
  - C. Fieldbus adapters Optional protocols such as LonWorks, DeviceNet, Ethernet IP (ControlNet over Ethernet & ModBus TCP), BACnet IP, and Profibus shall be available with the addition of an option card.

### 1.15 BYPASS CONTROLLERS

- A. A complete factory wired and tested bypass system consisting of a door interlocked, padlockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses are required. UL Listed motor overload protection shall be provided in both drive and bypass modes. An optional drive service switch (+F267) isolates the drive from the power source for service and provides superior functionality to a three-contactor arrangement.
- B. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the "Off" position before either enclosure may be accessed.

- C. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 amps and this rating shall be indicated on the UL data label.
- D. Drive Isolation Fuses To ensure maximum possible bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted.
- E. The system (VFD and Bypass) tolerated voltage window shall allow the system to operate from a line of +30%, -35% nominal voltage range. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.
- F. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.
- G. Motor protection from single phase power conditions the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.
- H. The bypass system shall NOT depend on the VFD for bypass operation. The bypass system shall be designed for stand alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed.
- I. Serial communications the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet.
- J. Serial communication capabilities shall include, but not be limited to; bypass run-stop control; the ability to force the unit to bypass; and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output keypad "Hand" or "Auto" selected, bypass selected, and broken belt indication. The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.
- K. The bypass serial communications shall allow control of the bypass' digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The bypass' digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the bypass' digital inputs shall be capable of being monitored by the DDC system.
- L. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the building automation protocol and / or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause only a warning or a fault and / or system shutdown.
- M. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 ma of 24 VDC for use by others to power external devices.
- N. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open (motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close.

The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.

- O. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to fire a Form-C relay output, and / or over the serial communications protocol.
- P. The bypass control shall include a programmable time delay for bypass start and keypad indication that this time delay is in process. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 120 seconds.
- Q. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS / DDC system even with the VFD removed.
- R. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
- S. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFD's analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps even with the VFD out of service.
- T. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.
- U. Smoke Control Override Mode (Override 1) The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties as required by UL 864/UUKL. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.
- V. Fireman's Override Mode (Override 2) the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction". The user may also force the unit into Override 2 via the serial communications link.
  W. Class 10, 20, or 30 (programmable) electronic motor overload protection shall be included.

# PART 2 - EXECUTION

- 2.1 GENERAL WORKMANSHIP
  - A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
- 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.

# 2.2 FIELD QUALITY CONTROL

- A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

# 2.3 WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 26 of these specifications. Where the requirements of this section differ with those in Division 26, the requirements of this section shall take precedence.
- B. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that circuits meet NEC Class 2 (current limited) requirements. (Low voltage power circuits shall be sub fused when required to meet Class 2 current limit.)
- C. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
- D. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage 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 shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 3 m [10 ft] intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 1.5 m [5 ft] intervals or more often to achieve a neat and workmanlike result.
- F. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- G. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.
- H. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.
- I. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.
- J. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.
- K. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- L. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- M. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as built) wiring diagrams with terminations identified at the job site.

N. Flexible metal conduits and liquid tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid tight, flexible metal conduits shall be used.

END OF SECTION 230900

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.
  - 6. Concrete bases.

#### 1.3 DEFINITIONS

- A. 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 tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
  - 2. Service Regulators: 65 psig (450 kPa) 100 psig (690 kPa) minimum unless otherwise indicated.
  - 3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).
- B. Natural-Gas System Pressure within Buildings: 0.5 psig (3.45 kPa) or less.

#### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

- 1. Piping specialties.
- 2. Corrugated, stainless-steel tubing with associated components.
- 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
- 4. Pressure regulators. Indicate pressure ratings and capacities.
- 5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings.
- 6. Dielectric fittings.
- B. Delegated-Design Submittal: For natural-gas 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.
  - 1. Detail fabrication and assembly of seismic restraints.
  - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

# 1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- 1.7 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For motorized gas valves pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

### 1.8 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

### 1.10 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
  - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

### 1.11 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

### PART 2 - PRODUCTS

#### 2.1 PIPES, TUBES, AND FITTINGS

- 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 aboveground and stainless steel underground.
  - 5. Mechanical Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Dresser Piping Specialties; Division of Dresser, Inc.
      - 2) Smith-Blair, Inc.

- b. Stainless-steel flanges and tube with epoxy finish.
- c. Buna-nitrile seals.
- d. Stainless-steel bolts, washers, and nuts.
- e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
- f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

### 2.2 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 (3.45 kPa).
  - 6. End Fittings: Zinc-coated steel.
  - 7. Threaded Ends: Comply with ASME B1.20.1.
  - 8. Maximum Length: 72 inches (1830 mm.)
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
  - 1. Copper-alloy convenience outlet and matching plug connector.
  - 2. Nitrile seals.
  - 3. Hand operated with automatic shutoff when disconnected.
  - 4. For indoor or outdoor applications.
  - 5. Adjustable, retractable restraining cable.
- C. 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 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
  - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig (862 kPa).
- D. 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.

#### 2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig (862 kPa).
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
  - 6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig (862 kPa).
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. Lyall, R. W. & Company, Inc.
    - d. McDonald, A. Y. Mfg. Co.
    - e. Perfection Corporation; a subsidiary of American Meter Company.
  - 2. Body: Bronze, complying with ASTM B 584.
  - 3. Ball: Chrome-plated bronze.
  - 4. Stem: Bronze; blowout proof.
  - 5. Seats: Reinforced TFE; blowout proof.
  - 6. Packing: Threaded-body packnut design with adjustable-stem packing.
  - 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 8. CWP Rating: 600 psig (4140 kPa).
  - 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves: MSS SP-78.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
- 2. Body: Bronze, complying with ASTM B 584.
- 3. Plug: Bronze.
- 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 5. Operator: Square head or lug type with tamperproof feature where indicated.
- 6. Pressure Class: 125 psig (862 kPa).
- 7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flowserve.
    - b. Homestead Valve; a division of Olson Technologies, Inc.
    - c. McDonald, A. Y. Mfg. Co.
    - d. Milliken Valve Company.
    - e. Mueller Co.; Gas Products Div.
    - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
  - 2. Body: Cast iron, complying with ASTM A 126, Class B.
  - 3. Plug: Bronze or nickel-plated cast iron.
  - 4. Seat: Coated with thermoplastic.
  - 5. Stem Seal: Compatible with natural gas.
  - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. Operator: Square head or lug type with tamperproof feature where indicated.
  - 8. Pressure Class: 125 psig (862 kPa).
  - 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. PE Ball Valves: Comply with ASME B16.40.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kerotest Manufacturing Corp.
    - b. Lyall, R. W. & Company, Inc.
    - c. Perfection Corporation; a subsidiary of American Meter Company.
  - 2. Body: PE.
  - 3. Ball: PE.
  - 4. Stem: Acetal.
  - 5. Seats and Seals: Nitrile.
  - 6. Ends: Plain or fusible to match piping.

- 7. CWP Rating: 80 psig (552 kPa).
- 8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
- 9. Operator: Nut or flat head for key operation.
- 10. Include plastic valve extension.
- 11. Include tamperproof locking feature for valves where indicated on Drawings.
- H. Valve Boxes:
  - 1. Cast-iron, two-section box.
  - 2. Top section with cover with "GAS" lettering.
  - 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
  - 4. Adjustable cast-iron extensions of length required for depth of bury.
  - 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

### 2.5 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Pacific Seismic Products, Inc.
  - 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 3. Maximum Operating Pressure: 0.5 psig (3.45 kPa).
  - 4. Cast-aluminum body with stainless-steel internal parts.
  - 5. Nitrile-rubber, reset-stem o-ring seal.
  - 6. Valve position, open or closed, indicator.
  - 7. Composition valve seat with clapper held by spring or magnet locking mechanism.
  - 8. Level indicator.
  - 9. End Connections: Threaded for valves NPS 2 (DN 50) and smaller; flanged for valves NPS 2-1/2 (DN 65) and larger.

# 2.6 PRESSURE REGULATORS

- A. Appliance Pressure Regulators: Comply with ANSI Z21.18.
  - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
    - a. Canadian Meter Company Inc.
    - b. Eaton Corporation; Controls Div.
    - c. Harper Wyman Co.
    - d. Maxitrol Company.
    - e. SCP, Inc.
  - 2. Body and Diaphragm Case: Die-cast aluminum.
  - 3. Springs: Zinc-plated steel; interchangeable.
  - 4. Diaphragm Plate: Zinc-plated steel.
  - 5. Seat Disc: Nitrile rubber.
  - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

- 7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
- 8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
- 9. Maximum Inlet Pressure: 1 psig (6.9 kPa).

### 2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International Ltd.
    - e. Matco-Norca, Inc.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Matco-Norca, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solderjoint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.
- 2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig (1035 kPa).
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

### 2.8 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) 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 (750 mm) deep; colored yellow.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for natural-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 natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

#### 3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install fittings for changes in direction and branch connections.
- C. Paint all exposed natural gas piping gray.

### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

- 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
- 2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing guick-set additives or cinder aggregate.
- 3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
- 4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
  - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
- 5. Prohibited Locations:
  - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
  - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

## 3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

### 3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. 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 dryseal 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.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

### 3.7 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
  - 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
  - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

- 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
- 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
  - 2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
  - 3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

# 3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### 3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

### 3.10 PAINTING

- A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, 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 (semigloss).
    - d. Color: Gray.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

# 3.11 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

### 3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

# 3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

## 3.14 OUTDOOR PIPING SCHEDULE

- A. Aboveground natural-gas piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought steel fittings and welded joints.
- B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### 3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
  1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

# 3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
  - 1. Bronze plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
  - 1. Bronze plug valve.
  - 2. Cast-iron, lubricated plug valve.
- E. Valves in branch piping for single appliance shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.

END OF SECTION 231123

# SECTION 232113.33 – GROUND-LOOP HEAT-PUMP PIPING

### Part 1: General

1.1 Provide a complete Geothermal Heat Exchanger (GLHE) as shown on the drawings, to couple to the Geothermal Heat Pump units specified elsewhere, to provide an ARI 330 Ground Source Closed Loop Heat Pump system.

1.2 The entire loop system shall be freeze protected to 15 F (20% propylene glycol), measured by volume. All materials used shall comply with all local and state laws, ordinances and codes.

### Quality Assurance

1.3 Manufacturers Qualifications: Firms regularly engaged in manufacture of Geothermal Loop Heat Exchanger products and tools of the types, materials, and sizes required; whose products have been in satisfactory use in similar service applications for not less than 5 years.

1.4 Installer's Qualifications: Installer must have completed a certified training program, or be a certified Geothermal Service Contractor (GSC), and shall have at least five years of successful installation experience on projects with geothermal Loop Heat Exchanger work similar in size and scope that is required for this project.

1.5 Fabricator's Qualifications: The only acceptable method for joining pipe that is to be buried is by a heat fusion process. Geothermal Loop Heat Exchanger fabricators must have completed a heat fusion school in which each participant has been certified in heat fusion procedures under direct supervision of a Certified Heat Fusion Technician.

**1.6** Codes and Standards: Comply with all local and state laws and ordinances.

#### <u>Submittals</u>

1.7 Product Data: Submit manufacturer's technical, product data and installation instructions for geothermal loop heat exchanger piping materials and products. Include product data for propylene glycol solution and grout.

1.8 Installer and Fabricator's Qualifications: Submit names and certificates of successful completion of the required schools.

1.9 Record Drawings: Accurate dimensional drawings of the geothermal loop heat exchanger, prepared by a licensed surveyor, shall be submitted as "AS BUILT" drawings.

#### Part 2: Products

2.1 Provide piping and pipe fittings in accordance with the following listing:

a) The piping shall be PE3408 (high-density polyethylene) with minimum cell classification 345444C per ASTM D-3350 'Standard Specification for Polyethylene Plastics Pipe and Fittings Materials'. Resistance to environmental stress cracking is critical to long life expectancy. Therefore, as a more stringent requirement, the piping material shall Jefferson Elementary School Henderson County Schools Henderson, Kentucky

demonstrate zero failures after 5.000 hours under condition 'C' (100% reagent at 100 C) when tested in accordance with ASTM D-1693, -Standard Test Method of Environmental Stress-Cracking of Ethylene Plastics'. A 50 year limited warranty (in writing) must be issued by the pipe supplier.

Vertical Loop

Furnish Pipe and Pipe Fittings as supplied by: Chevron/Performance Pipe, Centennial Pipe and Lamson.

Only the following standard sizes of PE3408 are acceptable:

1"	IPS SDR-11	6"	IPS SDR-15.5
1.25"	IPS SDR-11	8"	IPS SDR-15.5
2"	IPS SDR-11		
3"	IPS SDR-11		
4"	IPS SDR-11		

The same manufacturer from identical materials meeting the requirements of this specification shall produce pipe and fittings.

2.2 Heat Exchanger (Vertical Loop): The Geothermal Loop Heat Exchangers consist of Polyethylene piping, fusion joined into vertical loops and connected with horizontal headers. The Geothermal Loop Heat Exchanger work is completely outside the building. The headers shall be located as shown on drawings.

2.3 All vertical Geothermal Loop Heat Exchangers (GLHE's) shall be constructed of high-density polyethylene pipe, SDR-11. Each GLHE shall be closed by means of a single factory supplied U-bend similar to uni-coil at the bottom of the loop. The U-bend shall be attached to the GLHE using the heat fusion banding method.

2.4 Each GLHE shall be pressure tested immediately before insertion into the bore hole and again after manifolding. Testing shall be by air or water pressure, at up to 100 psi for a minimum of 30 minutes. Exercise suitable safety precautions during testing to guard against injury to personnel near lines being tested, in case of pipe system component or joint failure under pressure. Results of all tests shall be recorded and supplied to the engineer upon completion of the project, or as required by the engineer. The upper ends of each GLHE shall be marked with geothermal piping metallic tracer tape, buried 2' to 18" below grade. (The horizontal piping shall be marked also.)

2.5 All vertical GLHE bore holes shall be grouted completely with bentonite clay grout OR Bentonite based Thermally Enhanced Grout, with a minimum thermal conductivity of 1.00 BTU/hr-ft-F. The Bentonite and Silica compounds shall be field missed with clear potable water to a density of 14.4 lbs. Per gallon, solids content of 70.6%, linear shrinkage potential of less than 3% and permeability of less than 6.9 x 10. Grout shall be applied with a positive displacement piston pump at a rate of 5 to 15 gallons per minute. No more than one hour after the drilling of each borehole.

2.6 Grout compound manufacturer shall provide analysis of a minimum of six field collected grout samples over the course of the project. The installing contractor, in manufacturer-supplied containers, shall take samples during the grouting of the first bore then at 5 equal intervals, including the last bore.

2.7 Test results shall be sent to the installing contractor and the engineer. Any grout samples found to be short of specified requirements, will cause subsequent bores to be grouted in excess of the specified thermal conductivity to maintain a field average equal to the specified minimum. Grouting material shall be by GeoPro, Inc. or approved equal.

2.8 All vertical GLHE bore holes shall be grouted completely in conformance with the International Ground Source heat Pump Association's (IGSHPS) standards specified in their publication "Proper Grouting Procedures for Ground-source Heat Pump System", and all State and Local requirements.

2.9 Contractor shall monitor each borehole and continue adding grout as required, as settling occurs.

2.10 Geothermal Piping: All piping shall be constructed of high-density, polyethylene pipe, minimum SDR-11. All joints shall be made using the heat fusion joining method. Piping shall be purchased in such lengths and installed in such manner as to minimize the number of fusion joints required. All piping shall be installed at a minimum depth of 4 feet below final grade. Piping supply and return lines or bundles shall be separated to minimize thermal interference between the two. The number of points where supply and return lines cross one another shall be minimized.

After connections to the vertical GLHE, each lateral shall be pressure tested. Testing shall be by air or water pressure, at up to 100-psi for a minimum of 30 minutes. Exercise suitable safety precautions during testing, to guard against injury to personnel near lines being tested, in case of pipe system component, or joint failure under pressure. Results of all tests shall be recorded and supplied to the Engineer upon completion of the Project, or as required by the Engineer.

2.11 Compaction of Backfills and Fill:

2.12 Clean fill sand, free of large or sharp rocks or debris, shall be sued to cover all geothermal pipe to a cover depth of two feet (2') above pipe. Refer to Section 312000 for backfill procedures. Place backfill and fill materials in layers that are acceptable to that specific site location.

**2.13** Open ends of all geothermal pipes shall be sealed to prevent the entry of contaminants until final connections are made.

### PART 4: Execution

4.1 Examine areas and conditions under which geothermal loop heat exchanger systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

**4.2** The vertical holes of bores shall be clean (no permanent casing) and of sufficient diameter to facilitate the installation of the U-tube assembly. The bores shall be backfilled with appropriate grout material to assure pipe contact, and shall not contain large, sharp or jagged rocks or debris. Reasonable and prudent care shall be taken during installation and grouting in order not to crush, cut or kink the pipe. Pump grout into borehole to discharge at base of borehole.

4.3 The horizontal and lateral ditches for the Geothermal Loop Heat Exchanger piping may be dug with trenching machine, and/or backhoe. The piping shall be buried to the minimum of 48" deep. Clean out all debris from trench before placing piping. After the piping is installed, tested, purged, inspected and approved, backfill with sand, rock free backfill material. Coordinate the layer of the header piping with existing utilities, new mechanical and electrical utilities.

### 4.4 Installation of Piping

- a) Install piping in accordance with manufacturer's written instructions.
- b) The pipe and pipe fittings must be joined using the socket or butt heat fusion process. No other method is acceptable. The vertical loop take-off tee fittings may be made using the saddle fusion process on header piping larger than 1-1/4". Exercise extreme caution to completely remove the cutout material. On header piping 1-1/4" and smaller use

regular tee fittings. Bell reducer fittings. Or reducing tees shall be used at all pipe reductions to eliminate trapped air.

- c) Avoid sharp bends in piping, Install elbow fittings if necessary.
- d) Connect to hydronic water piping using adapter fittings in the mechanical room.
- e) Provide tracer tape above all lateral lines at 18" below grade.
- f) Provide warning tape above all lateral lines at 12" below grade.
- g) Provide GPS coordinated mapping of all vertical and lateral lines.
- 4.5 Testing and Cleaning
  - a. During installation, trash, soil and small animals shall be kept out of the pipe. Ends of the high-density polyethylene pipe shall be taped and capped until the pipe is joined to the circuit.
  - b. Each polyethylene loop assembly shall be pressure tested prior to installation and again prior to backfilling the trenches. Testing shall be by air or water pressure, at up to 100 psi for a minimum of 30 minutes. Exercise suitable safety precautions during testing to guard against injury to personnel near lines being tested, in case of pipe system component or joint failure under pressure. Results of all tests shall be recorded and supplied to the engineer upon completion of the project, or as required by the engineer. Repair leaks and retest until no leaks exist.
- 4.6 Flushing and Purging the System
  - a. All systems shall be flushed and purged of air and flow tested to ensure all portions of the heat exchanger are properly flowing. A portable temporary purging unit shall be utilized and shall consist of the following: purge pump high volume and high head: open reservoir; filter assembly with bypass; connecting piping, connection hoses and flow meter.
  - b. Using the purging unit described above flush and purge each Geothermal Loop Heat Exchanger system forward and in reverse until free of air, dirt and debris. A velocity of 3 ft./sec. is required in all pipe sections to remove the air. The flushing and purging operation should be conducted with the water source heat pump piping isolated with shut off valves. After the Geothermal Loop Heat Exchanger is completely flushed of air and debris, open the isolation valves and permit circulation through the heat pump portion of the system until the entire system is flushed and purged. The isolation valves at each of the heat pump units are to be closed during this activity, or the hoses to each pump unit joined together to form a loop. Do not flush and purge through the heat pump unit.
  - c. Do not allow the acid solution used to purge and flush the indoor metal pipe system to the heat pump units, to become mixed with the solution in the GLHE.
  - d. Utilizing the purging unit conduct a pressure and flow test on the Geothermal Loop Heat Exchanger to ensue the system is free of blockage. If the flow test indicated blockage, locate the blockage systematically clamping off loops with a pinch-off tool, remove the blockage, then repurge and conduct the pressure and flow test again until all portions of

the system are flowing. The flow test must be observed and approved by the test and balance contractor.

- e. Test and balance contractor shall witness and verify flow and pressures are met.
- f. Report must include visual documentation of fitler cleanliness. Filter shall be a minimum of 50 micron.
- g. The Geothermal Loop Heat Exchanger Inspection report is to be filled out by the Contractor and is to be witnessed by the Engineer.

# PART 5: Material, Testing, Certification & Listing

**5.1** The pipe and fitting manufacturer shall certify that samples of his production pipe have undergone stress regression testing, evaluation, and validation in accordance with Certification ASTM D-2837 and PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the pipe and fitting manufacturer to be 1600 psi at 73.4 F. and 800 psi at 140 F.

**5.2** Material shall be listed in the name of the pipe and fitting manufacturer by the Plastic Pipe Institute (PPI) in PPI TR-4 with the following Standard Grade ratings:

	73.40	140F
Hydronic Design Basis (HDB)	1600 psi	800 psi
Hydronic Design Stress (HDS)	800 psi	400 psi

PPI Material listing in the name of the resin supplier is not acceptable in meeting this requirement.

**5.3** Pipe fittings: Pipe and fittings shall be produced by the same manufacturer from identical materials meeting the requirements of this specification.

**5.4** Pipe and fittings shall be pressure-rated to meet the service requirements specified by the Design Engineer. Whether molded or fabricated, fittings shall be fully pressure-rated to at least the same service pressure rating as the pipe to which joining is intended.

**5.5** Molding fittings shall meet the requirements of ASTM D-3261 and the specification. At the point of fusion, the outside diameter and minimum wall thickness specifications of the mating system piping. Fitting markings shall include a production code from which the location and date of manufacture can be determined. Upon request, the manufacturer shall provide an explanation of his production code.

**5.6** Fittings shall be manufactured in facilities designed for that purpose. Field fabricated fittings are not allowed.

**5.7** Outside diameter controlled pipe shall be manufactured in accordance with ASTMF714 or ASTM D-3035. Upon request, the manufacturer shall provide an explanation of his production code.

### PART 6: Manufacturer Quality Control and Assurance

6.1 The pipe and pipefitting manufacturer shall have an established quality control program responsible for inspecting incoming and outgoing materials. At a minimum, incoming polyethylene materials shall be inspected for density per ASTM D-1505, melt flow per rate ASTM D1238, and
contamination. The supplier shall certify all incoming polyethylene materials. Certifications shall be verified by Quality Control before processing into finished goods.

6.2 All outgoing materials shall be inspected for diameter, wall thickness, length, straightness, out-ofroundness, concentricity, toe-in, inside and outside surface finish, marking, and end out. Quality Control shall perform tests of density; melt flow rate, carbon content, and carbon dispersion. In addition, samples of the pipe provided shall be tested for hoop tensile strength and ductility by either quick burst per ASTM D-01599 or ring tensile per ASTM D-2290. Molded fittings production shall be subject to x-ray inspection for voids, and tests for knit line strength. All fabricated fittings shall be inspected for fusion quality and alignment.

6.3 The pipe and fitting manufacturer shall have an established quality assurance program responsible for assuring long-term performance of materials and products. Representative samples of polyethylene materials shall be tested against the physical property requirements of the specification. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D-1598. Quality assurance tests for representative pipe and fitting samples shall include:

<u>Test</u>	<u>Standard</u>	<u>Pipe</u>	<u>Fittings</u>
Ring ESCR Sustained Pressure at 176 F/725 psi Hoop Stress	ASTM F-1248 ASTM D-1598	yes yes (f0>100h) yes (f0>100h)	N/A yes (f0>100h) yes (f0>100h)
Sustained Pressure at 73 F/1600 psi Hoop Stress	ASTM D-1598		

6.4 The pipe and fitting manufacturer shall maintain permanent QC and QA records.

6.5 The pipe and fitting manufacturer shall provide certified copies of the quality control data taken during product manufacture.

END OF SECTION 232113.33

SECTION 232113 - HYDRONIC PIPING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Geothermal water piping.
  - 2. Makeup-water piping.
  - 3. Condensate-drain piping.
- B. Related Sections include the following:
  - 1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

#### 1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.
- B. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- C. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Geothermal Water Piping: 125 psig (kPa) at 200 deg. F (93 deg. C).
  - 2. Makeup-Water Piping: 80 psig (552 kPa) at 150 deg F (66 deg C).
  - 3. Condensate-Drain Piping: 150 deg F (66 deg C).

#### 1.5 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 2. Air control devices.
  - 3. Chemical treatment.
  - 4. Hydronic specialties.

- B. Operation and Maintenance Data: For air control devices, hydronic specialties, and specialduty valves to include in emergency, operation, and maintenance manuals.
- C. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- B. 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 ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

# PART 2 - PRODUCTS

- 2.1 COPPER TUBE AND FITTINGS
  - A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
  - B. DWV Copper Tubing: ASTM B 306, Type DWV.
  - C. Wrought-Copper Fittings: ASME B16.22.
  - D. Wrought-Copper Unions: ASME B16.22.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

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- 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:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Anvil International, Inc.
    - b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
    - c. National Fittings, Inc.
    - d. Victaulic Company of America.
  - Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

#### 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

# 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper-alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Zurn Plumbing Products Group; AquaSpec Commercial Products Division.
  - 2. Factory-fabricated union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 3. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Calpico, Inc.
  - b. Lochinvar Corporation.
- 2. Galvanized-steel coupling with inert and noncorrosive thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- G. Dielectric Nipples:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Perfection Corporation; a subsidiary of American Meter Company.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Victaulic Company of America.
  - 2. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

## 2.5 VALVES

- A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - c. Flow Design Inc.
    - d. Griswold Controls.
  - 3. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  - 4. Ball: Brass or stainless steel.
  - 5. Plug: Resin.
  - 6. Seat: PTFE.
  - 7. End Connections: Threaded or socket.
  - 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 9. Handle Style: Lever, with memory stop to retain set position.

- 10. CWP Rating: Minimum 125 psig (860 kPa).
- 11. Maximum Operating Temperature: 250 deg F (121 deg C).
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump; a division of ITT Industries.
    - c. Flow Design Inc.
    - d. Griswold Controls.
  - 3. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
  - 4. Ball: Brass or stainless steel.
  - 5. Stem Seals: EPDM O-rings.
  - 6. Disc: Glass and carbon-filled PTFE.
  - 7. Seat: PTFE.
  - 8. End Connections: Flanged or grooved.
  - 9. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 10. Handle Style: Lever, with memory stop to retain set position.
  - 11. CWP Rating: Minimum 125 psig (860 kPa).
  - 12. Maximum Operating Temperature: 250 deg F (121 deg C).

## 2.6 HYDRONIC PIPING SPECIALTIES

- A. 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 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
  - 3. Strainer Screen: 40, 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: 125 psig (860 kPa).

### 2.7 AIR CONTROL DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Amtrol, Inc.
  - 2. Armstrong Pumps, Inc.
  - 3. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - 4. Taco.
- B. Manual Air Vents:
  - 1. Body: Bronze.
  - 2. Internal Parts: Nonferrous.
  - 3. Operator: Screwdriver or thumbscrew.

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- 4. Inlet Connection: NPS 1/2 (DN 15).
- 5. Discharge Connection: NPS 1/8 (DN 6).
- 6. CWP Rating: 150 psig (1035 kPa).
- 7. Maximum Operating Temperature: 225 deg F (107 deg C).
- C. Automatic Air Vents:
  - 1. Body: Bronze or cast iron.
  - 2. Internal Parts: Nonferrous.
  - 3. Operator: Noncorrosive metal float.
  - 4. Inlet Connection: NPS 1/2 (DN 15).
  - 5. Discharge Connection: NPS 1/4 (DN 8).
  - 6. CWP Rating: 150 psig (1035 kPa).
  - 7. Maximum Operating Temperature: 240 deg F (116 deg C).
- D. Bladder-Type Expansion Tanks:
  - 1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
  - 3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
- E. Tangential-Type Air Separators:
  - 1. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.
  - 2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
  - 3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
  - 4. Blowdown Connection: Threaded.
  - 5. Size: Match system flow capacity.

## PART 3 - EXECUTION

## 3.1 PIPING APPLICATIONS

- A. Geothermal heating piping, aboveground, NPS 2 (DN 50) and smaller, shall be any of the following:
  - 1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and brazed, pressureseal joints.
  - 2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Geothermal Water Piping, aboveground, NPS 2-1/2 (DN 65) and larger, shall be any of the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

- 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Makeup-water piping installed aboveground shall be either of the following:
  - 1. Type L (B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

# 3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

# 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.

- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, inline pump, and elsewhere as indicated. Install NPS 3/4 (DN 20) nipple and ball valve in blowdown connection of strainers NPS 2 (DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2 (DN 50).
- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

## 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
  - 2. Adjustable roller hangers for individual horizontal piping 20 feet (6 m) or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
  - 4. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
  - 4. NPS 2 (DN 50): Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).
  - 5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (10 mm).
  - 6. NPS 3 (DN 80): Maximum span, 12 feet (3.7 m); minimum rod size, 3/8 inch (10 mm).
  - 7. NPS 4 (DN 100): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).
  - 8. NPS 6 (DN 150): Maximum span, 17 feet (5.2 m); minimum rod size, 1/2 inch (13 mm).
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
  - 4. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
- F. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

#### 3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using leadfree solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

# 3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

## 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

## 3.8 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.
- B. 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.
- C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

## 3.9 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. Install blinds in flanged joints to isolate equipment.
  - 5. Install 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 "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, such as boilers, chillers, cooling towers, to specified values.
  - 7. Verify lubrication of motors and bearings.

END OF SECTION 23 2113

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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Separately coupled, base-mounted, end-suction centrifugal pumps.
- 1.3 DEFINITIONS
  - A. Buna-N: Nitrile rubber.
  - B. EPT: Ethylene propylene terpolymer.

#### 1.4 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

### 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 size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Mechanical Seals: One mechanical seal(s) for each pump.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

- A. Available Manufacturers:
  - 1. Armstrong Pumps Inc.
  - 2. Bell & Gossett; Div. of ITT Industries.
  - 3. Taco, Inc.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting,

with pump and motor shafts horizontal. Rate pump for 175-psig (1204-kPa) minimum working pressure and a continuous water temperature of 225 deg F (107 deg C).

- C. Pump Construction:
  - 1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and threaded companion-flange connections.
  - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
  - 3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
  - 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
  - 5. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
  - 6. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.
- D. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.
- E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
- F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.
- G. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

## 2.3 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle pattern, 175-psig (1204-kPa) pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 23 Section "Common Work Results for HVAC."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

#### 3.3 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- C. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- D. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
  - 1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches (19 to 38 mm) between pump base and foundation for grouting.
  - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

## 3.4 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

# 3.5 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check valve and throttling valve on discharge side of pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
- I. Install electrical connections for power, controls, and devices.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## 3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. 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.
    - c. Verify that pump is rotating in the correct direction.
  - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 6. Start motor.
  - 7. Open discharge valve slowly.

# 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 2123

SECTION 232300 - REFRIGERANT PIPING

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
  - 2. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

#### 1.4 SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

# 1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

# 1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

# PART 2 - PRODUCTS

# 2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B).
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

## 2.2 VALVES AND SPECIALTIES

- A. Service Valves:
  - 1. Body: Forged brass with brass cap including key end to remove core.
  - 2. Core: Removable ball-type check valve with stainless-steel spring.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Copper spring.
  - 5. Working Pressure Rating: 500 psig (3450 kPa).
- B. Thermostatic Expansion Valves: Comply with ARI 750.
  - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Packing and Gaskets: Non-asbestos.
  - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  - 5. Suction Temperature: 40 deg F (4.4 deg C).
  - 6. Superheat: Adjustable.
  - 7. Reverse-flow option (for heat-pump applications).
  - 8. End Connections: Socket, flare, or threaded union.
  - 9. Working Pressure Rating: 700 psig (4820 kPa), 450 psig (3100 kPa).
- C. Moisture/Liquid Indicators:
  - 1. Body: Forged brass.
  - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  - 3. Indicator: Color coded to show moisture content in ppm.
  - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  - 5. End Connections: Socket or flare.
  - 6. Working Pressure Rating: 500 psig (3450 kPa).

7. Maximum Operating Temperature: 240 deg F (116 deg C).

### 2.3 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

### PART 3 - EXECUTION

## 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 3-1/2 (DN 90) and Smaller for Conventional Air-Conditioning Applications: Copper, Type L (B), drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- B. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

#### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.

- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install pipe sleeves at penetrations in exterior walls and floor assemblies.
- Q. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."
- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- T. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.
- U. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

## 3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

## 3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
  - 5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
- D. Support multifloor vertical runs at least at each floor.

## 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

- 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
  - a. Fill system with nitrogen to the required test pressure.
  - b. System shall maintain test pressure at the manifold gage throughout duration of test.
  - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
  - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

# 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
  - 4. Charge system with a new filter-dryer core in charging line.

#### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

## SECTION 232500 - HVAC WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
  - 1. Glycol make-up unit.
  - 2. HVAC water-treatment chemicals.

#### 1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. RO: Reverse osmosis.
- C. TDS: Total dissolved solids.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems shall have the following water qualities:
  - 1. pH: Maintain a value within 9.0 to 10.5.
  - 2. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
  - 3. Soluble Copper: Maintain a maximum value of 0.20 ppm.
  - 4. TDS: Maintain a maximum value of 10 ppm.
  - 5. Microbiological Limits:
    - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

# 1.5 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
  - 1. Glycol make-up unit.
  - 2. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
  - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
  - 2. Water Analysis: Illustrate water quality available at Project site.

#### 1.6 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: Acceptable suppliers shall be American Water Treatment, Kesco, Mogul, Dearborn or Betz.

#### 1.7 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for heating, hot-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
  - 1. Initial water analysis and HVAC water-treatment recommendations.
  - 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  - 3. Periodic field service and consultation.
  - 4. Customer report charts and log sheets.
  - 5. Laboratory technical analysis.
  - 6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

## PART 2 - PRODUCTS

#### 2.1 GLYCOL MAKE-UP UNIT

A. Furnish and install as shown on the plans and specifications a packaged, automatic glycol solution make up unit model GMU as manufactured by ITT Bell & Gossett or approved equal. The package shall consist of a bae, polyethylene reservoir with removable lid, visivle solution level scale in gallons and liters, y-strainer, isolation valve, pump, open drip-proof motor, pump

isolation, check and balance valve, expansion tank, discharge pressure gage, motor contactor and control circuit in a NEMA 4 panel, and necessary interconnecting piping. Green light shall indicate power supplied to unit. Pump shall start based on falling pressure. Unit includes low level cutout, with red indicator light and 110V contact for alarm indication, to stop the pump during low level condition. Contractor shall furnish application specific pressure reducing valve between GMU and connection to the system piping.

## 2.2 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

## PART 3 - EXECUTION

## 3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

# 3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for seismic restraints.
- C. Install water testing equipment on wall near water chemical application equipment.
- D. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, and equipped with the following:
  - 1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
  - 2. Install a full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
  - 3. Install a swing check on inlet after the isolation valve.

## 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."

- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- E. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- F. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.

# 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Tests and Inspections:
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
  - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
  - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
  - 7. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
  - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.
- E. Comply with ASTM D 3370 and with the following standards:
  - 1. Silica: ASTM D 859.
  - 2. Acidity and Alkalinity: ASTM D 1067.
  - 3. Iron: ASTM D 1068.
  - 4. Water Hardness: ASTM D 1126.

# 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 232500

SECTION 233113 - METAL DUCTS

#### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round and flat-oval ducts and fittings.
  - 3. Sealants and gaskets.
  - 4. Hangers and supports.
  - 5. Seismic-restraint devices.
- B. Related Sections:
  - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated.
  - 1. Static-Pressure Classes:
    - a. Supply Ducts: 2-inch wg.
    - b. Return Ducts (Negative Pressure): 2-inch wg.
    - c. Exhaust Ducts (Negative Pressure): 1-inch wg.
    - d. Ventilation Supply Ducts Upstream of air terminal units: 6-inch wg.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and SEI/ASCE 7. SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
  - 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
  - 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
  - 2. AWS D1.2/D1.2M, "Structural Welding Code Aluminum," for aluminum supports.
  - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up".
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation".

#### PART 2 - PRODUCTS

#### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

#### 2.2 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lindab Inc.
  - b. McGill AirFlow LLC.
  - c. SEMCO Incorporated.
  - d. Sheet Metal Connectors, Inc.
  - e. Spiral Manufacturing Co., Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Transverse Joints Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

# 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards

   Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".
- D. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.
  - 5. Use: O.
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

### 2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## PART 3 - EXECUTION

#### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

## 3.2 DUCT SEALING

- A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

## 3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

# 3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." SEI/ASCE 7.
  - 1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  - 2. Brace a change of direction longer than 12 feet (3.7 m).
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
  - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

## 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

## 3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

## 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
  - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."
  - 2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 3. Test for leaks before insulation application.
  - 4. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing. Report pressure test findings to engineer.
- C. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
  - Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## 3.8 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing if the system has been found to be dirty.
- B. Use service openings for entry and inspection.
  - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.

- C. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  - 4. Coils and related components.
  - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  - 6. Supply-air ducts, dampers, actuators, and turning vanes.
  - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
  - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
  - 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
  - 6. Provide drainage and cleanup for wash-down procedures.
  - 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

# 3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting and Balancing for HVAC".

# 3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

- B. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel.
- C. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm (5 m/s) or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm (7.6 m/s) or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows."
    - Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      - 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam, Welded.
- D. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-6, "Branch Connections."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
- 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
  - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

SECTION 233300 - AIR DUCT ACCESSORIES

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. Manual volume dampers.
  - 2. Fire dampers.
  - 3. Flange connectors.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
  - 8. Duct accessory hardware.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
    - e. Duct security bars.
    - f. Wiring Diagrams: For power, signal, and control wiring.

# 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

## PART 2 - PRODUCTS

## 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

#### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 (Z180), G90 (Z275).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

#### 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Standard leakage rating, with linkage outside airstream.
  - 2. Suitable for horizontal or vertical applications.
  - 3. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 4. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

- 5. Blade Axles: Galvanized steel.
- 6. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 7. Tie Bars and Brackets: Galvanized steel.

# 2.4 FIRE DAMPERS

- A. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- B. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- C. Fire Rating: 1-1/2 hours.
- D. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.05 (1.3 mm) thick, as indicated, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.
- G. Blades: Roll-formed, interlocking, 0.024-inch- (0.61-mm) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

# 2.5 FLANGE CONNECTORS

- A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- B. Material: Galvanized steel.
- C. Gage and Shape: Match connecting ductwork.

## 2.6 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

# 2.7 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch ((25-by-25-mm))butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.

## 2.8 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
  - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

# 2.9 FLEXIBLE DUCTS

- A. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
  - 1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
  - 2. Maximum Air Velocity: 4000 fpm (20 m/s).
  - 3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
  - 4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

#### PART 3 - EXECUTION

# 3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install fire smoke dampers according to UL listing.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. At outdoor-air intakes and mixed-air plenums.
  - 2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 3. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
  - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
  - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
  - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
  - 5. Body Access: 25 by 14 inches (635 by 355 mm).
  - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- I. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- J. Install flexible connectors to connect ducts to equipment.
- K. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- L. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
- M. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.

# 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, dampers to verify full range of movement and verify that proper heatresponse device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

# SECTION 233400 - HIGH VOLUME LOW SPEED HVAC FANS

# PART 1 GENERAL

## 1.1 SUMMARY

- A. Section Includes
  - 1. The ceiling-mounted circulation fan is the model scheduled with the capacities indicated on drawings. The fan shall be furnished with standard mounting hardware and variable speed control to provide cooling and destratification.
- B. Summary of Work
  - 1. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses, and disconnect switches, other than those addressed in the installation scope of work, shall be provided by others.

# **1.2 RELATED SECTIONS**

- A. 21 00 00 Fire Suppression
- B. 23 00 00 Heating, Ventilating, and Air Conditioning (HVAC)
- C. 26 00 00 Electrical

# 1.3 REFERENCES

- A. National Fire Protection Agency (NFPA)
- B. Underwriters Laboratory (UL)
- C. Canadian Standards Association (CSA)
- D. National Electric Code (NEC)
- E. International Organization for Standardization (ISO)

# 1.4 SUBMITTALS

- A. Shop Drawings: Drawings detailing product dimensions, weight, and attachment methods
- B. Part 2 Product Data: Specification sheets on the ceiling-mounted fan, specifying electrical and installation requirements, features and benefits, and controller information
- C. Installation Guide: The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan. All information is subject to change without notice.
- D. Schedule

# 1.5 QUALITY ASSURANCE

- A. Certifications
  - 1. The fan assembly, as a system, shall be ETL-certified and built pursuant to the guidelines set forth by UL standard 507 and CSA standard 22.2 No. 113.
  - 2. The fan shall be compliant with Canada ICES-003, Class B and has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.
  - 3. The fan shall be compliant with NFPA 13—Standard for the Installation of Sprinkler Systems, NFPA 72— National Fire Alarm and Signaling Code, and NFPA 70-2011—NEC.
- Controllers shall comply with NEC and UL standards and shall be labeled where required by code.
  Manufacturer Qualifications
  - 1. The fan and any accessories shall be supplied by a manufacturer that has a minimum of ten (10) years of product experience.

- 2. ISO 9001-certified
- 3. The manufacturer shall not be listed on the Air Movement and Control Association International Inc. (AMCA) Certified Ratings Program (CRP) Non-Licensed Products report in the previous 18 months.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver product in original, undamaged packaging with identification labels intact. The fan shall be new, free from defects, and factory tested.
- B. The fan and its components shall be stored in a safe, dry location until installation.

# 1.7 WARRANTY

A. The manufacturer shall replace any products or components defective in material or workmanship for the customer free of charge (including transportation charges within the USA, pursuant to the complete terms and conditions of the manufacturer Non-Prorated Warranty in accordance to the following schedule:

Item	Period of Coverage
Hub and airfoils	Lifetime (Parts)
Motor, drive, and controller	10 years
Labor	1 year

# PART 2 PRODUCT

# 2.1 MANUFACTURER

A. Available manufacturers offering products that may be incorporated into the work shall include, but are not limited to: Big Ass Fans, Greenheck and Macro Air.

# 2.2 HIGH VOLUME, LOW SPEED FANS

- A. Complete Unit
  - 1. Regulatory Requirements: The entire fan assembly shall be ETL-certified and built pursuant to the construction guidelines set forth by UL standard 507 and CSA standard 22.2. No. 113.
  - 2. Sustainability Characteristics: The fan shall be designed to move an effective amount of air for cooling and destratification of conditioned commercial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 40 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
  - 3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.
- B. Controls
  - 1. The fan controller shall be incorporated into the fan assembly and housed in an enclosure independent of the motor to prevent overheating or electrical interference. The fan controller shall be factory programmed to minimize starting and braking torques, and include a BacNet adapter.
- C. Airfoil System
  - 1. The fan shall be equipped with ten (10) high volume, low speed airfoils of precision extruded aluminum alloy. Each airfoil shall be of the high-performance TEC design. The airfoils shall be connected to the hub and

interlocked with ten (10) stainless steel retainers and two (2) high strength locking bolts per airfoil. Nut covers shall be provided.

- 2. The fan shall be equipped with ten (10) TEC winglets designed to redirect outward airflow downward, thereby enhancing efficiency. The winglets shall be die cast aluminum and shall be attached at the tip of each airfoil. The standard color of the winglets shall be black.
- 3. The fan shall be equipped with ten (10) airfoil trim inserts that nest between the hub and the inner edge of each airfoil. The trim inserts shall provide a cleaner fit between the airfoils and the hub to help reduce drag, turbulence, and noise. The standard color of the trim inserts shall be black.
- D. Motor
  - The fan motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed from 0–100% without the use of a gearbox or other mechanical means of control. The motor shall operate from any voltage ranging from 100–240 VAC, single phase, and 50/60Hz, without requiring adapters or customer selection. The motor shall be a non-ventilated, heat sink design with the capability of continuous operation in -40°F to 131°F (-40°C to 55°C) ambient conditions.
- E. Mounting System
  - 1. The fan mounting system shall be designed for quick and secure installation from a variety of structural supports. All components in the mounting system shall be of welded construction and made from A36 steel no less than 3/16" (0.5 cm) thick. The mounting system shall be powder coated for appearance and resistance to corrosion. All mounting bolts shall be SAE Grade 8 or equivalent. No mounting hardware substitutions, including cast aluminum, are acceptable.
  - 2. For mounting through ceiling media, a factory supplied trim accessory (escutcheon) shall be provided to maintain a professional, finished installation.
- F. Hub
  - 1. The fan hub shall be a single precision permanent mold casting of aluminum alloy for high strength and light weight. The hub shall be precision machined to achieve a well-balanced and solid rotating assembly.
  - 2. The hub shall incorporate ten (10) safety pins made of aluminum that shall restrain the hub/airfoil assembly in case of a shaft failure. The safety pins shall be attached to the body of the hub by means of high strength bolts.
- G. Safety Cables
  - The fan shall be equipped with upper and lower safety cables. The upper safety cable shall provide an additional means of securing the fan assembly to the building structure. The lower safety cable shall provide an additional means of securing the motor unit to the mounting system. Both safety cables shall be Ø3/16" (0.5 cm) diameter and fabricated out of 7 x 19 stranded galvanized steel. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf (13,345 N).
  - 2. Field construction of safety cables is not permitted.
- H. Wall Control
  - 1. The fan shall be equipped with a remote wall control providing control of all fan functions. The wall control shall be capable of mounting to a standard electrical box by means of an included mounting plate.
  - 2. The wall controller shall be equipped with a 1.8" (4.6 cm) TFT-LCD screen and user interface for controlling the fan's direction, operation, and speed.
  - 3. Communication with the fan drive and controller shall be by a standard, commercially available CAT-5 (or higher) Ethernet cable that is field installed and provided by the installer. A 5 ft (1.5 m) patch cable shall be provided to test and verify communication signals locally prior to connecting the remote connection cable.
  - 4. The wall control shall be equipped with a simple diagnostic program to identify faults in the system. Provisions shall be made for retrieving fan operation and diagnostic data (fault messages) through the remote wall control.
  - 5. The wall controller shall include a BacNet adapter for integration into the facilities building automation system.
- I. Fire Control Panel Integration
  - 1. Includes a 10–30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

- J. Guy Wires
  - 1. Guy wires shall be included for installations with extension tubes 4 ft (1.2 m) or longer to limit the potential for lateral movement.

# PART 3 EXECUTION

# **3.1 PREPARATION**

- A. Fan location shall have a typical bar joist or existing I-beam structure from which to mount the fan. Additional mounting options may be available.
- B. Mounting structure shall be able to support weight and operational torque of fan. Consult structural engineer if necessary.
- C. Fan location shall be free from obstacles such as lights, cables, or other building components.
- D. Check fan location for proper electrical requirements. Consult Installation Guide for appropriate circuit requirements.
- E. Each fan requires dedicated branch circuit protection.

# **3.2 INSTALLATION**

- A. The fan shall be installed by a factory-certified installer according to the manufacturer's Installation Guide, which includes acceptable structural dimensions and proper sizing and placement of angle irons for bar joist applications.
- B. Minimum Distances
  - 1. Airfoils shall be at least 10 ft (3 m) above the floor.
  - 2. Installation area shall be free of obstructions such as lights, cables, sprinklers, or other building structures with the airfoils at least 2 ft (0.61 m) clear of all obstructions.
  - The structure the fan is attached to shall be capable of supporting a torque load of up to 300 ft<sup>-</sup>lb (407 N<sup>-</sup>m) of torque.
- C. The fan shall not be located where it shall be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters.
- D. In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall comply with all of the following:
  - 1. The maximum fan diameter shall be 24 ft (7.3 m).
  - 2. The HVLS fan shall be centered approximately between four adjacent sprinklers.
  - 3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft (0.9 m).
  - 4. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system in accordance with the requirements of NFPA 72—National Fire Alarm and Signaling Code.

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section Includes:1. In-line centrifugal fans.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

# 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## PART 2 - PRODUCTS

## 2.1 IN-LINE CENTRIFUGAL FANS

- A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- D. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Companion Flanges: For inlet and outlet duct connections.
  - 3. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

## 2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

# 2.3 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

# 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

# 3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

- 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

# 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

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 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section Includes:1. Shutoff, single-duct air terminal units.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
  - 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
  - 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
  - 1. Air terminal units.
  - 2. Liners and adhesives.
  - 3. Sealants and gaskets.
  - 4. Seismic-restraint devices.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
- D. Laboratory Test Reports: For adhesives, indicating compliance with requirements for lowemitting materials.

- E. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Instructions for resetting minimum and maximum air volumes.
  - 2. Instructions for adjusting software set points.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-Up."

# PART 2 - PRODUCTS

# 2.1 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Price Industries.
  - 2. Carrier
  - 3. Trane
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch (0.85-mm) steel, single wall.
  - 1. Casing Lining: Adhesive attached, 1-inch- (25-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
    - a. Cover liner with nonporous foil.
  - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
  - 3. Air Outlet: S-slip and drive connections.
  - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F (minus 18 to plus 60 deg C), shall be impervious to moisture and fungus, shall be suitable for 10-inch wg (2500-Pa) static pressure, and shall be factory tested for leaks.
- E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

- 1. Maximum Damper Leakage: ARI 880 rated, [2] [3] percent of nominal airflow at 3-inch wg (750-Pa) inlet static pressure.
- 2. Damper Position: Normally closed.

# 2.2 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Steel Cables: Galvanized steel complying with ASTM A 603.
- D. 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. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

# 2.3 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

# 2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
  - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

## 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 3.3 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on air terminal units that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

- G. Drilling for and Setting Anchors:
  - Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavyduty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

#### 3.4 CONNECTIONS

- A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts."
- B. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "Air Duct Accessories."

# 3.5 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

## 3.6 FIELD QUALITY CONTROL

- A. 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.

#### 3.7 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.

# 3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
  - 2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volumecontrol dampers not integral to diffusers, registers, and grilles.

## 1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

# PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

# 2.2 GRILLES AND REGISTERS

- A. Refer to Schedule on Drawings.
  - 1. Available Manufacturers:

- a. Anemostat; a Mestek Company.
- b. Price Industries.
- c. Titus.
- B. Material: Aluminum unless noted on drawings otherwise.
- C. Color: By Architect.

# 2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

# 3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

# SECTION 233716 - FABRIC AIR-DISTRIBUTION DEVICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section includes continuous, tubular, fabric air-distribution devices.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
- B. Shop Drawings: For fabric air-distribution devices.
  - 1. Include plans, elevations, sections, and suspension and attachment details and internal support structure details.
- C. Samples for Initial Selection: For diffusers with factory-applied color finishes.
- D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected.
- E. Diffuser Schedule: Use same designations indicated on Drawings. Indicate room location, quantity, model number, size, and accessories furnished.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Source quality-control reports.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Provide products by one of the following or approved equal:
  - 1. Duct Sox
  - 2. Fabric Air
  - 3. Prihoda.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Continuous tubular diffuser materials shall be listed and labeled as complying with UL 2518, UL 723, NFPA 90A, NFPA 90B.
- B. Air permeability of fabric will comply with ASTM D737.

## 2.3 CONTINUOUS TUBULAR DIFFUSERS

- A. Description:
  - 1. Fabric: Woven anti-microbial polyester, anti-static polyester, permeable polyester.
  - 2. Shape: Round or Oval with internal support system.
  - 3. Air-Outlet Configuration: Circumferential hole pattern.
  - 4. Air-Outlet Configuration: Periodic nozzles.
  - 5. Air-Outlet Configuration: Linear vents.
  - 6. Color: Provide physical color samples to Archiect for selection.
  - 7. See plans for additional requirements.
- B. Duct Connection Type: Round zipper.
- C. Accessories:
  - 1. Quick-connect joint.
  - 2. Snap hooks.
  - 3. Cleanout zipper.
  - 4. Condensate drain.
  - 5. Fabric damper.
  - 6. End cap.
  - 7. Draw cords.
  - 8. Removable internal support system.
  - 9. Elbows.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

A. Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow

pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

SECTION 237413 - PACKAGED, DEHUMIDIFICATION AIR-HANDLING UNITS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes packaged, indoor, dehumidification air-handling units with the following components and accessories:
  - 1. Coils.
  - 2. Filters.
  - 3. Fans.
  - 4. Energy Recovery Wheel.
  - 5. Water Source Heat Pump.
  - 6. Auxiliary Heater,

#### 1.3 DEFINITIONS

- A. DDC: Direct-digital controls.
- B. ECM: Electrically commutated motor.
- C. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- D. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

#### 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each unit, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.

- C. Manufacturer Seismic Qualification Certification: Submit certification that unit accessories, and components will withstand seismic forces defined in "Performance Requirements" Article and in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.
- G. Sustainable Design:
  - 1. Product Data: For refrigerants
  - 2. Product Data: For energy performace
- 1.5 QUALITY ASSURANCE
  - A. ARI Compliance:
    - 1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies.
  - B. ASHRAE Compliance:
    - 1. Comply with ASHRAE 15 for refrigeration system safety.
    - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
    - 3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
  - C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 "Heating, Ventilating, and Air-Conditioning."
  - D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
  - E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

# 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

- 2. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
- 3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

# 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Belts: One set for each belt-driven fan.
  - 2. Filters: One set of filters for each unit.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal prior to bid:
  - 1. Valent.
  - 2. Desert Aire
  - 3. XeteX
  - 4. Addision

# 2.2 UNIT DESCRIPTION

- A. Unit Enclosure:
  - 1. A 12-gauge galvanized base rail shall be incorporated in units that are over 120" in length. Units that are less then 120" in length shall be manufactured with a 12-gauge base galvanneal panel.
  - 2. The unit shall be double wall 16-gauge galvanneal outer panels and 22-gauge galvanized metal inner liner
  - 3. Supports shall be constructed of 12-gauge galvanneal steel.
  - 4. Hinged Access Doors shall allow easy access to internal components within each section. Each door shall have a minimum of two cam latched. Weatherproof compression gaskets shall seal between the door and unit casing to produce an airtight seal.
  - 5. Single Side Service Access The unit shall be designed for complete access for service and maintenance from one side only. Units that require access from both sides are unacceptable. See mechanical drawings for access side required.
  - 6. The electrical control panel shall be in its own separate compartment.
  - 7. All external fasteners shall be stainless steel bolts. Self-taping or drive screws are unacceptable.
  - 8. The insulation shall be 1" solid foam sandwiched in the double wall cabinet with a minimum "R" factor of 5.0.
- B. Paint and Finish: Prior to painting, all metal parts shall be pretreated to remove oils and dirt and rinsed with an ionized solution. Painting shall be by a powder coat technique to assure positive adherence with a high impact finish. All sides of panels shall be painted after manufacturing.

The paint shall be High Yield Polyester. The paint shall be rated to meet a minimum of 1,000hour salt spray test (ASTM B117), have a minimum Direct Impact Resistance of 160 in-lbs (ASTM D2794), have a minimum flexibility of ¼" Mandrel (ASTM D522, Method B) and a minimum 1000-hour Humidity Resistance (ASTM D2247).

- C. Exhaust Air Energy Recovery Rotary Wheel System:
  - 1. Enhanced Enthalpy Wheel:
    - a. Wheel Design: The rotor matrix shall be manufacturer of a corrosion resistant aluminum alloy that is composed of alternating corrugated and flat, continuously wound layers of uniform widths to guarantee laminar air flow, and low static pressure loss. The matrix will have a minimum depth of 7.5 inches and be of modular construction. Polymer, corrugated synthetic fibrous and any other non-metallic media are not acceptable. The rotor wheel should be reinforced with spokes, welded at the hub and perimeter to prevent any uneven run out during normal operations.
    - b. Desiccant Type: All corrugated surfaces must be coated with a thin non-migrating synthetic zeolite adsorbent layer; with a pore size no greater than a 4 Angstrom; prior to being formed into the media structure to insure that all surfaces are coated and that adequate latent capacity is provided. Etched or oxidized aluminum surfaces are not acceptable. Silica Gel desiccants are not acceptable due to its lack of ability to prevent cross contamination of odor causing substances. The wheels effectiveness must be documented through a certification program conducted in accordance with ASHRAE 84 and ARI 1060 standards. The certification must have been conducted by a qualified independent organization that is recognized by AHRI.
    - c. Unit Housing: The self supported housing shall be made of galvanized steel to prevent corrosion. For rotor housing 2000 mm (79 inches) and less, the rotor wheel is supported by two internal, maintenance-free, antifriction, permanently sealed bearings that are located and protected within the surrounding wheel hub. For rotor housing larger that 2000 mm (79 inches), the rotor wheel shall be supported by two maintenance-free sealed pillow block bearings that are located within the housing and protected from the air stream.
    - d. Rotor Seals: The rotor shall be sealed with horizontal and circumference felt seals to ensure an absolute minimum leakage, while maintaining a friction free operation. Circumference felt seals shall seal to the face of wheel perpendicular to airflow to minimize wheel bypass of air. Brush seal are not acceptable.
    - e. Drive System: The rotor wheel must be driven by a self-adjusting belt system, which includes an A/C motor, nylon reinforced belt with linkage, and a springtensioned motor plate. The A/C motor must be capable of performing under constant and variable speed applications.
    - f. Certification: The wheels effectiveness must be clearly documented through a certification program conducted in accordance with ASHRAE 84 standards and ARI 1060. The certification must have been conducted by a qualified independent organization that is recognized by AHRI.
  - 2. Frost Protection: The manufacture shall provide a Variable Frequency Drive (VFD). The VFD shall drive the wheel at maximum speed until the exhaust air's relative humidity reaches 95% to eliminate wheel frosting. The VFD shall vary the wheel speed to maintain the RH maximum to optimize energy recovery.
  - 3. Exhaust Air Blower Assembly:
    - a. Blower Housing: The blower housing shall be made of galvanized steel and mounted on permanently lubricated sealed ball bearings. The blower assembly shall be forward curved, centrifugal; it shall be dynamically and statically balanced with a stainless steel fan shaft. The blower housing shall be vibration isolated.

- b. Blower Discharge: The unit's air discharge shall be a horizontal discharge.
- c. Blower Pulley Assembly: The driver pulley and the blower pulley shall be made of cast iron. The motor sheave shall be a variable pitch type to allow for field adjustment of CFM and external static pressure, and shall be dynamically and statically balanced with a stainless steel fan shaft. The drive overload service factor shall be minimum of 1.2.
- d. Blower Motor: The motor shall be ODP (indoor) or TEFC (outdoor), class B insulated, continuous-duty, 40C ambient, three–phase overloads. The motor shall be UL listed.
- D. Refrigeration System:
  - 1. Refrigerant: The system's operating refrigerant shall be R-410A only.
  - 2. Compressors: (<6 HP): The compressor shall be heavy-duty scroll type, single compressor complete with start kit on single-¬phase motors. The compressor shall be equipped with low and high-pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated. The use of semi-hermetic compressors is not acceptable.
  - 3. Compressors: (7.5 to 30 HP): The compressors shall be a tandem pair, heavy–duty scroll type. A factory-mounted sensor that will deactivate one compressor when the load reaches the mid-range of the systems capacity shall stage the compressors. The compressor shall be equipped with high- and low-pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated. The use of semi-hermetic compressors is not acceptable.
  - 4. Compressors: (>35 HP): The compressors shall be a dual circuit, tandem pair, and heavy–duty scroll type. A factory-mounted sensor that will deactivate each compressor when the load reaches the quarter-range of the system's capacity shall stage the compressors. The compressor shall be in the dehumidifier and equipped with high- and low-pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated. The use of semi-hermetic compressors is not acceptable.
  - 5. Hot Gas Bypass: The unit shall include hot gas bypass for each system compressor set. The hot gas bypass is to be used only for the prevention of coil freeze up and not for compressor unloading.
  - 6. Receiver: The unit shall include a refrigerant receiver. The receiver shall assist the unit in operating at the highest efficiency over a wide range of load conditions.
- E. Evaporative Dehumidifier Coils:
  - 1. Fins: Fins shall be die formed, raised lanced aluminum, and be damage resistant. Extruded fin collars provide maximum heat transfer. Fin spacing shall be 10 fins per inch (FPI). The coil shall be a maximum of 30" in height
  - 2. Tubes: Coil shall be fabricated from seamless drawn copper. The inner tubing shall be rifled to produce turbulent refrigeration flow to enhance the heat transfer process. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. The coil shall be a minimum of six (6) rows deep. The use of smooth tube coils will require an 8 row coil to equal the performance of the above referenced coil.
  - 3. Coils shall be leak tested with 540 psig of nitrogen.
- F. Water Source Heat Pump (Q-Pump):
  - 1. The water cooled dehumidifier shall be equipped with a liquid chiller that allows the refrigerant to extract heat from a water loop during heat pump operation.
- 2. The liquid chiller shall be piped in series with a water condenser with the water condenser first with respect to incoming water flow from the water loop. Unwanted heat shall be rejected back to the water loop for maximum energy efficiency to control leaving air temperature to set point.
- 3. The system shall be capable of simultaneous heat of rejection to both the hot gas reheat coil and the water condenser and control the LAT within +/- 0.2oF.
- 4. The liquid chiller and the water condenser shall be brazed plate heat exchanger. The heat exchanger shall consist of stainless steel plates copper brazed together to resist a maximum working temperature of 350°F. The heat exchanger shall be factory helium leak tested at 500-psi for quality assurance and have a maximum working pressure of 450-psi. The brazed plate heat exchanger shall be UL listed.
- 5. The head pressure shall be controlled by the system's internal flooding valve.
- 6. Units shall have the liquid chiller wrapped in insulation and heat traced. The heat tracing shall be wired back to the control panel for an independent 120V power connection.
- G. Auxiliary Heater:
  - 1. The capacity shall be in accordance with the unit schedule.
  - 2. The heater shall be integral to the unit and wired to the units as a single point power connection. No external duct mount heaters are acceptable.
  - 3. The heater coils shall be constructed of high grade nickel-chrome alloy and insulated by floating ceramic bushings from the galvanized steel frame. Coil terminal pins shall be stainless steel insulated by means of non-rotating ceramic bushings.
  - 4. The heater shall be equipped with fail-safe disc-type thermal cut-outs.
  - 5. The heater shall include high limit cut-outs, magnetic contactors as required, a control transformer, and an airflow switch.
  - 6. The electric heater and unit shall be provided as a single point power connection.
- H. Unit Location: The unit shall be designed for indoor installation. The installing contractor shall provide 4" housekeeping pad.
- I. Electrical Control Panel: The electrical control panel shall be easily accessible. It shall be of adequate size to house all electrical controls and devices. The unit shall be provided with single point power connection to serve controls, fans, electric auxiliary heater, and compressors, factory wired to the power connection lug set. The electrical controls shall include low voltage transformers to supply 24 VAC control power, clearly labeled high- and low-voltage terminal strips, high- and low-pressure control (with manual reset of the high-pressure cutout and automatic reset of low-pressure cutout), and an anti-short-cycling timer to protect against compressor cycling.
  - 1. Disconnect: Provide with a factory mounted and wired disconnect switch.
  - 2. GFI Outlet: Provide a 13-amp, 120-volt electrical outlet.
- J. Control System:
  - 1. A digital control system shall be used to accurately and precisely control the DESERT AIRE dehumidification system and the leaving air temperature requirements.
  - 2. Controller: The controller shall provide precise system control and feature an easy-toread control mounted display which indicates actual operating and set-points.
  - 3. The unit shall include factory mounted temperature and humidity sensors in the filter section, pre-wired to controller in panel for actuation of compressor in ambient temperatures above the user selected dew point set point, 55oF (programmable) or above 70oF.
  - 4. Discharge Temperature Sensor: The unit shall include a discharge temperature sensor used to control the discharge temperature set point ± 0.2 degrees of set point.
  - 5. BMS Compatibility: (Optional, Pick one if required) The units controller shall have the following BMS compatibility:

- a. The unit's controller shall be BACnet compatible.
- K. Condensate Drain Pan: The drain pan shall be 20-gauge stainless steel, sloped, and positioned under the dehumidifier coil. The drain pan shall be TIG welded and securely attached to the evaporator endplates to avoid shifting. The drain pan shall be fitted with a minimum 1" MPT non-corrosive plastic drain connection. The drain pan shall meet all the requirements of ASHRAE Standard 62.
- L. Supply Air Blower Assembly:
  - 1. The blower housing shall be made of galvanized steel and mounted on permanently lubricated sealed ball bearings. The blower assembly shall be forward curved, centrifugal; it shall be dynamically and statically balanced with a stainless steel fan shaft. The blower housing shall be vibration isolated.
  - 2. Blower Discharge: The unit's air discharge shall be as shown on the mechanical drawings.
  - 3. Blower Pulley Assembly: The driver pulley and the blower pulley shall be made of cast iron. The motor sheave shall be a variable pitch type to allow for field adjustment of CFM and external static pressure, and shall be dynamically and statically balanced with a stainless steel fan shaft. The drive overload service factor shall be a minimum of 1.2.
  - 4. Blower Motor: Unless otherwise specified, blower motors 7.5 HP and less shall be TEFC, 10 HP and above shall be ODP class B insulated, continuous-duty, 40C ambient, three–phase overloads. The motor shall be UL listed.
- M. Air Filters: The system shall be provided with MERV 8 disposable filters consisting of 4" pleated filter.
- N. Warranty: The unit shall be manufactured of the finest quality components which are readily available as off-the-shelf replacement parts throughout North America. All components shall be warranted for a period of two (2) years from date of unit shipment. Although the warranty begins on the date of shipment, the manufacturer shall not replace any component without a valid start-up report on file. In addition, the manufacturer shall provide the following extended warranties (Optional):
  - 1. Provide an extended 3-year compressor warranty for a combined warranty of 5-years.
- O. Approvals/Listings: The unit shall be labeled and listed by ETL or UL.
- P. Unit Manufacturer: The unit shall be manufactured by DESERT AIRE CORPORATIOJN, Germantown, Wisconsin, USA. The manufacture must be an active member of the ARI Dehumidification group.

## 2.3 EXECUTION

- A. Preparation: Installing contractor to provide all labor, refrigerant, and material required for a complete installation. (Minimum 3 feet clearance on all service sides.) Work to be performed shall be in accord with local codes, regulations, and OSHA standards.
- B. Delivery, Storage and Handling: Customer to provide a suitable space for the equipment with proper access and entries. Unit to be stored in a clean, dry place and protected from the outdoor environment. Handle with care to avoid damage.
- C. Installation: Unit shall be installed per plans and manufacturer's installation recommendations.
- D. Field Quality Control:

- E. Installing contractor to clean, check, and perform all preliminary start up procedures before final operation of the unit, per manufacturer's recommendations.
- F. Provide complete operation/maintenance manuals (in English) and include the following minimum lists: electrical and control drawings, and refrigeration piping drawings. Manufacturer's representative shall instruct owners/operators of the unit regarding its functions and sequence of operation.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

## 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- B. Tests and Inspections:
  - 1. After installing unit and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

### 3.4 STARTUP SERVICE

- A. Prior to operating the AHU, the Contractor shall complete a Pre-Startup Checklist (PSC) for the unit. An example of a typical Air Handling Unit PSC is provided below. The actual checklist shall be provided to the Contractor by the Commissioning Authority (CxA) after review of project submittals. The Contractor shall provide a paper copy of the completed checklist to the CxA for verification prior to start up, and for inclusion in the Cx System Manual.
- B. Engage a factory-authorized service representative to perform startup service.
  - 1. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

### 3.5 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing unit and airdistribution systems, clean filter housings and install new filters.

### 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain unit. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237413

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

### 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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Sustainable design:
  - 1. Product Data: For refrigerants.
  - 2. Product Data: For energy performance

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.
- 1.5 CLOSEOUT SUBMITTALS
  - A. Operation and Maintenance Data: For split-system air-conditioning 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 set(s) for each air-handling unit.
  - 2. Fan Belts: One set(s) for each air-handling unit fan.

### 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. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

### 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of equipment supports with actual equipment provided.

### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Seven year(s) from date of Substantial Completion.
    - b. For Parts: Five year(s) from date of Substantial Completion.
    - c. For Labor: One year(s) from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Provide products by one of the following:
  - 1. Mitsubishi

- 2. LG
- 3. Daikin

# 2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Wall-Mounted, Evaporator-Fan Components:
  - 1. Cabinet: Enameled steel with discharge drain pans with drain connection.
  - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermalexpansion valve. Comply with ARI 206/110.
  - 3. Fan: Direct drive, centrifugal.
  - 4. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Enclosure Type: Totally enclosed, fan cooled.
    - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    - f. Mount unit-mounted disconnect switches on exterior of unit.
  - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - 6. Condensate Drain Pans:
    - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      - 2) Depth: A minimum of 1 inch (25 mm) deep.
    - b. Single-wall, galvanized-steel sheet.
    - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      - 1) Minimum Connection Size: NPS 1 (DN 25).
    - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
  - 7. Air Filtration Section:
    - a. General Requirements for Air Filtration Section:
      - 1) Comply with NFPA 90A.
      - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
      - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

## 2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
  - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - c. Refrigerant Charge: R-410A.
    - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
  - 3. Fan: Aluminum-propeller type, directly connected to motor.
  - 4. Motor: Permanently lubricated, with integral thermal-overload protection.
  - 5. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
  - 6. Mounting Base: Polyethylene.

#### 2.4 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Drain Hose: For condensate.

## 2.5 CAPACITIES AND CHARACTERISTICS

A. Refer to drawings for capacities and characteristics.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

- C. Equipment Mounting:
  - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

# 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Allow space for service and maintenance of unit.
- 3.3 FIELD QUALITY CONTROL
  - A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
  - B. Perform tests and inspections.
    - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - C. Tests and Inspections:
    - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
    - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - D. Remove and replace malfunctioning units and retest as specified above.
  - E. 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.

# 3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

# SECTION 238146 - WATER-SOURCE UNITARY HEAT PUMPS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following types of water-source heat pumps:
  - 1. Concealed horizontal or vertical units, 6 tons (21 kW) and smaller.

### 1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each model.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Product Certificates: For each type of water-source heat pump, signed by product manufacturer.
- D. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For water-source heat pumps to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.
- H. Sustainable design:
  - 1. Product Data: For refrigerants.
  - 2. Product Data: For energy performance

## 1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of watersource heat pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

- 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. ASHRAE Compliance:
  - 1. ASHRAE 15.
  - 2. Applicable requirements in ASHRAE 62.1-2004, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."
- D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 "Heating, Ventilating, and Air-Conditioning."
- E. Comply with NFPA 70.
- F. Comply with safety requirements in UL 484 for assembly of free-delivery water-source heat pumps.
- G. Comply with safety requirements in UL 1995 for duct-system connections.

## 1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water-source heat pumps that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, refrigeration components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- 2.2 WATER-SOURCE HEAT PUMPS, 6 TONS (21 kW) AND SMALLER

- A. Manufacturers:
  - 1. Carrier Corporation.
  - 2. Trane
  - 3. Waterfurnace.
  - 4. Climate master.
  - 5. Florida Heat Pump/Bosch
  - 6. Diakin
- B. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ARI-ISO-13256-1.
- C. Cabinet and Chassis: Galvanized-steel casing with the following features:
  - 1. Access panel for access and maintenance of internal components.
  - 2. Knockouts for electrical and piping connections.
  - 3. Flanged duct connections.
  - 4. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch (13 mm) thick with foil facing, complying with UL 181.
  - 5. Condensate Drainage: Plastic or stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1-2004.
  - 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Fan: Direct driven, centrifugal, with multispeed motor resiliently mounted in fan inlet.
  - 1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 2. Motor: Multispeed, permanently lubricated, ECM motor.
- E. Water Circuit:
  - 1. Refrigerant-to-Water Heat Exchangers:
    - a. Coaxial heat exchangers with cupronickel water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube leak tested to 450 psig (3102 kPa) on refrigerant side and 400 psig (2758 kPa) on water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.
  - 2. Water Regulating Valves: Limit water flow through refrigerant-to-water heat exchanger, and control head pressure on compressor during cooling and heating. Valves shall close when heat-pump compressor is not running.
- F. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 450 psig (3102 kPa).
- G. Refrigerant Circuit Components:
  - 1. Sealed Refrigerant Circuit: Change with R-410A refrigerant.
  - 2. Charging Connections: Service fittings on suction and liquid for charging and testing.
  - 3. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
  - 4. Compressor: Hermetic scroll compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties as follows:

- a. Antirecycle timer.
- b. High-pressure cutout.
- c. Low-pressure cutout or loss of charge switch.
- d. Internal thermal-overload protection.
- e. Freezestat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below 35 deg F (2 deg C).
- f. Condensate overflow switch to stop compressor with high condensate level in condensate drain pan.
- 5. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
- 6. Pipe Insulation: Refrigerant minimum 3/8-inch- (10-mm-) thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-development indexes according to ASTM E 84.
- 7. Refrigerant Metering Device: Thermal expansion valve to allow specified operation with entering-water temperatures from 25 to 125 deg F (minus 4 to plus 52 deg C).
- H. Extended Range for cooling when entering water temperature is below 50 degrees F.
- I. Filters: Disposable, pleated type, 2 inch thick and with a minimum of 90 percent arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value of 8 according to ASHRAE 52.2.
- J. Controls:
  - 1. By Temperature Control Contractor.
  - 2. Unit shall interface with Lonworks.
- K. Electrical Connection: Single electrical connection with fused disconnect.

## 2.3 HOSE KITS

- A. General: Hose kits shall be designed for minimum 400 psig (2758 kPa) working pressure, and operating temperatures from 33 to 211 deg F (0.5 to 99 deg C). Tag hose kits to equipment designations.
- B. Hose: Length 24 inches (600 mm). Minimum diameter, equal to heat-pump piping size.
- C. Isolation Valves: Two-piece bronze-body ball valves with stainless-steel ball and stem and galvanized-steel lever handle. Provide valve for supply and return. If balancing device is combination shutoff type with memory stop, the isolation valve may be omitted on the return.
- D. Strainer: Y-type with blowdown valve in supply connection.
- E. Balancing Device: Mount in return connection. Include meter ports to allow flow measurement with differential pressure gage.
  - 1. Manual, calibrated-orifice balancing valve.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of water-source heat pumps.
- B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduit before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Vertical water source heat pump Mounting:
  - 1. Install vertical water-source, unitary heat pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete".
  - 2. Comply with requirements for vibration-isolation and seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC".
  - 3. Comply with requirements for vibration-isolation devices specified in Section 230548.13 "Vibration Controls for HVAC".
- B. Suspended horizontal water-source unitary heat pumps from structure with all-thread hanger rods and spring hangers with vertical limit stop. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment". Vibration hangers are specified in Section 230548 "Vibration and Seismic Controls for HVAC".
- C. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls or as required in Section 230923 "Direct Digital Control (DDC) System for HVAC".

## 3.3 CONNECTIONS

- A. All connections to each heat pump shall be completed in a manner that does not conflict with the manufacturers minimum service access requirements.
- B. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
  - 1. Connect supply and return hydronic piping to heat pump with unions and shutoff valves or hose kits.
  - 2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:
  - 1. Connect supply and return ducts to water-source heat pumps with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."
- D. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
- E. Install piping adjacent to machine to allow service and maintenance.

- F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- H. Install pitched to drain per manufacturer.

## 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

# 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  - 1. Inspect for visible damage to unit casing.
  - 2. Inspect for visible damage to compressor, coils, and fans.
  - 3. Inspect internal insulation.
  - 4. Verify that labels are clearly visible.
  - 5. Verify that clearances have been provided for servicing.
  - 6. Verify that controls are connected and operable.
  - 7. Verify that filters are installed.
  - 8. Adjust vibration isolators.
  - 9. Inspect operation of barometric dampers.
  - 10. Verify bearing lubrication on fan.
  - 11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  - 12. Start unit according to manufacturer's written instructions.
  - 13. Complete startup sheets and attach copy with Contractor's startup report.
  - 14. Inspect and record performance of interlocks and protective devices; verify sequences.
  - 15. Operate unit for an initial period as recommended or required by manufacturer.
  - 16. Verify thermostat and humidistat calibration.
  - 17. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
  - 18. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
  - 19. Start refrigeration system and measure and record the following:
    - a. Coil leaving-air, dry- and wet-bulb temperatures.
    - b. Coil entering-air, dry- and wet-bulb temperatures.

- c. Outdoor-air, dry-bulb temperature.
- d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
- 20. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.

## 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 of 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 CLEANING

- A. Replace filters used during construction prior to air balance or substantial completion.
- B. After completing installation of exposed, factory-finished water-source heat pumps, inspect exposed finishes and repair damaged finishes.

# 3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water-source heat pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238146

# SECTION 238239.19 - WALL AND CEILING UNIT HEATERS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include details of anchorages and attachments to structure and to supported equipment.
  - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
  - 5. Wiring Diagrams: Power, signal, and control wiring.

### 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

## 2.1 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 CABINET

- A. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

### 2.3 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

### 2.4 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

#### 2.5 CONTROLS

- A. Controls: Unit-mounted thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

#### PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 238239.19

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Fire and smoke stopping.
  - 5. Common electrical installation requirements.

# 1.3 SUBMITTALS

A. Product Data: For sleeve seals.

#### 1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.
- D. Coordinate sleeve selection and application with selection and application of fire and smokestopping specified in Division 07 "Section "Penetration Fire-stopping".
- E. Coordinate electrical testing of electrical, mechanical and architectural items so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

# PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel, with minimum 0.052 or 0.138 inch thickness as indicated and of length to suit application.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.
- F. Install electrical equipment in accordance with the recommendations and requirements of the equipment manufacturer.
- G. All installation shall be in accordance with the applicable national, state, and local codes, including but not limited to, the National Electrical Code.
- H. Housekeeping Pads: All floor mounted equipment shall be provided with concrete housekeeping pads designed and installed in accordance with the requirements of Division 26 "Vibration and Seismic Controls for Electrical Systems."

# 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or smoke and fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Smoke and Fire-Rated Assemblies: Install sleeves for penetrations of smoke and fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 6 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal is to be installed or unless seismic criteria require a different clearance.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assembles.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Smoke and Fire-Rated-Assembly Penetrations: Maintain indicated smoke and fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with fire-stop materials. Comply with requirements in Division 07 Section "Penetration Fire-stopping".
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

## 3.3 SMOKE AND FIRESTOPPING

- A. Apply fire-stopping to penetrations of smoke and fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Fire-stopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping".
- B. Seal around outside of sleeves and conduit and within the inside of conduits and sleeves after conductors and cables have been installed.

# 3.4 ACCESS PANELS

A. Provide access panels in all locations where electrical items requiring access are installed behind finished ceilings, surfaces or otherwise concealed. In general, electrical items requiring access shall be located in areas that are accessible.

END OF SECTION 260500

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
- B. Related Sections include the following:
  - 1. Division 28 Section "Fire Alarm and Detection Systems" for single-conductor and multiconductor cables and terminations for electrical fire alarm systems.

## 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

## 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

## 2.2 CONDUCTORS AND CABLES

- A. Available Manufacturers:
  - 1. American Insulated Wire Corp.; a Leviton Company.
  - 2. General Cable Corporation.
  - 3. Senator Wire & Cable Company.
  - 4. Southwire Company.
  - 5. Rome Cable.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper stranded conductor, unless noted otherwise on the Contract Drawings.
- D. Conductor Insulation Types:
  - 1. Type THHN-THWN complying with NEMA WC 5.
- E. Multi-conductor Cable: Metal-clad cable, Type MC with full size ground wire and dedicated neutral conductor for each phase.
- 2.3 CONNECTORS AND SPLICES
  - A. Available Manufacturers:
    - 1. AFC Cable Systems, Inc.
    - 2. AMP Incorporated/Tyco International.
    - 3. Hubbell/Anderson.
    - 4. O-Z/Gedney; EGS Electrical Group LLC.
    - 5. 3M Company; Electrical Products Division.
  - B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.4 CONDUCTORS AND CABLES FOR SPECIALIZED SYSTEMS

- A. Conductors for specialized systems shall be as designated on the Contract drawings, or as specified elsewhere in the project specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.
  - 1. Fire Alarm Systems.

# 2.5 REMOTE CONTROL AND SIGNAL CABLE

- A. Control cables for Class 1 Remote control and Signal Circuits: Copper conductor 600 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with PVC jacket.
- B. Control cable for Class 2 or Class 3 Remote Control Signal Circuits: Copper conductor, 300 volt insulation, rated 60 degrees C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

PART 3 - EXECUTION

- 3.1 GENERAL WIRING METHODS
  - A. Minimum conductor size.
    - 1. Power and Lighting circuits: 12AWG
    - 2. Control Circuits: 14AWG.
  - B. Use 10 AWG conductors for (unless noted otherwise on Contract Drawings or specifications to be a larger size):
    - 1. 20 ampere, 120 volt branch circuit home runs longer than 75 feet,
    - 2. 20 ampere 208 volt branch circuit home runs longer than 150 feet.
  - C. The ampacity of multiple conductors in one conduit shall be derated per NEC Article 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than ¼ HP, panelboards, motor control centers, distribution panels, switchboards, and other distribution equipment.
  - D. Where installing parallel feeders, install an equal number of conductors for each phase of a circuit in the same raceway or cable.
  - E. Splice only in junction or outlet boxes. Feeder circuits shall not be spliced and shall be continuous from termination point to termination point.
  - F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
  - G. Make conductor lengths for parallel circuits equal.
  - H. All conductors shall be continuous in conduit from last outlet to their termination.

### 3.2 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Feeders: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits:
  - 1. Type THHN-THWN, single conductors in raceway.
  - 2. Lighting Fixture Whips: Multi-conductor type MC cable with ground wire.
    - a. Multi-conductor MC type cable <u>shall not</u> be used for any other application without the written approval of the Engineer.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- E. Fire Alarm Circuits: See Division 28 Section "Fire Alarm and Detection Systems" for requirements.
- F. Control Circuits: Type THHN-THWN, in raceway.

# 3.3 INSTALLATION

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- D. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems".
- E. Seal around cables penetrating fire-rated elements according to Division 07 Section "Penetration Fire-stopping".
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems".
- G. Shared Neutral Conductor. Unless noted otherwise, all circuits shall be provided with "dedicated" phase and neutral conductors. Neutral Conductors shall not be shared.
- H. Maximum number of conductors per conduit. The maximum number of current carrying conductors installed within conduits shall not exceed a quantity of eight. Neutral Conductors shall be considered as current carrying conductors.
- I. Install MC type branch circuit cables in accordance with the requirements of the National Electrical Code. Secure and support MC type cables per the National Electrical Code Requirements.

#### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
  - 1. Feeder circuits <u>shall not</u> be spliced or tapped unless specifically noted on the drawings, or approved in advance by the Owner.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

# END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment plus the following special applications:
  - 1. Power system grounding.
  - 2. Communication and electronic safety and security system grounding.
  - 3. Electrical equipment and raceway grounding and bonding.
  - 4. Primary distribution system grounding.
- B. Grounding requirements specified in this section may be supplemented by special requirements of systems described in other sections.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Comply with NFPA 70 for

## PART 2 - PRODUCTS

- 2.1 CONDUCTORS
  - A. Material: Copper.

- B. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction. Comply with conductor requirements of Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- C. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, 12 inches in length, unless otherwise indicated; with insulators, and pre-drilled and tapped bonding locations.
  - 1. Provide with plexiglass protective covers. Labels as noted on contract drawings.

# 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Irreversible compression type connectors: kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad Steel; <sup>3</sup>/<sub>4</sub> inch diameter by 10 feet in length, unless indicated otherwise.

## PART 3 - EXECUTION

## 3.1 APPLICATIONS

- A. Conductors: Install solid or stranded conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Grounding Bus: Install bus on insulated spacers, 1 inch minimum from wall, and 16 inches above finished floor, unless otherwise indicated. Install grounding buses within the following areas:
  - 1. All areas as indicated on the Contract Drawings.

- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Connections to Structural Steel: Welded connectors or irreversible compression type.
  - 3. Connections to Ground Rods: Welded connectors or irreversible compression fittings.
  - 4. Underground Connections: Welded connectors or irreversible compression fittings.
- D. Isolated Grounding Conductors:
  - 1. Green-colored insulation with continuous yellow strip. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

## 3.2 EQUIPMENT GROUNDING

- A. Install insulated green equipment grounding conductors with all:
  - 1. Feeders circuits
  - 2. Branch circuits
  - 3. Control circuits
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panel board equipment grounding terminals. Terminated at isolated equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

# 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- D. Ground Rods: Drive rods until tops are 12 inches below finished grade, unless otherwise indicated.
- E. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from buildings main, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange.
  - 2. Bond each above ground portion of gas piping system downstream from equipment shutoff valve.
- 3.4 BONDING
  - A. Services:
    - 1. The non-current carrying metal parts of equipment shall be effectively bonded together using grounding type bond bushings at each end of raceways.
  - B. Feeders and Branch Circuits:
    - 1. Metallic conduit raceways for feeders and branch circuits originating from distribution panels shall be effectively bonded together using grounding-type bond bushings on the course-of-feed side of the conduit raceway.
    - 2. Metallic raceways for all feeder circuits shall be bonded at each end (and at all pull boxes) using ground-type bond bushings.
  - C. Provide bond bushings at all locations as required by NFPA 70.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Seismic restraints for electrical equipment and systems.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IBC: International Building Code.
- C. IMC: Intermediate metal conduit.
- D. KBC: Kentucky Building Code.
- E. RMC: Rigid metal conduit.
- F. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

## 1.4 PERFORMANCE REUQIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

### 1.5 SUBMITTALS

- A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.
  - 1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
  - 2. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:
  - 1. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
- C. Qualification Data: For professional engineer.

#### 1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

## 1.7 PROJECT CONDITIONS

- A. Site Class as Defined in the IBC: Refer to Structural Drawings.
- B. Assigned Seismic Use Group or Building Category as Defined in the IBC: Refer to Structural Drawings.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.
- B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.
  - 1. Available Manufacturers:
    - a. Cooper B-Line; a division of Cooper Industries.
    - b. ERICO International Corporation.
    - c. Allied Support Systems; Power-Strut Unit.
    - d. GS Metals Corp.
    - e. Michigan Hanger Co., Inc.; O-Strut Div.
    - f. National Pipe Hanger Corp.
    - g. Thomas & Betts Corporation.
    - h. Unistrut; Tyco International, Ltd.
  - 2. Finishes:
    - a. Support channel: Hot-dip galvanized. Stainless steel for wet/damp locations; painted steel for interior dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
    - b. Hardware: Corrosion resistant. Stainless steel for wet/damp locations.
  - 3. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- C. Raceway and Cable Supports: As described in NECA 1.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers:
      - 1) Cooper B-Line; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc
      - 3) Hilti, Inc.
      - 4) ITW Construction Products.
      - 5) MKT Fastening, LLC.
      - 6) Powers Fasteners.

- 2. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
- 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- 4. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- 5. Toggle Bolts: All-steel springhead type.
- 6. Hanger Rods: Threaded steel.

## 2.3 SEISMIC-RESTRAINT COMPONENTS

- A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Strength in tension, shear, and pullout force of components used shall be at least five times the maximum seismic forces to which they will be subjected.
- B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.
- C. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.
  - 1. Manufacturers:
    - a. Amber/Booth Company, Inc.
    - b. Loos & Co., Inc.
    - c. Mason Industries, Inc.
  - 2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
  - 3. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
  - 4. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
  - 5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

# 2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

# PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction
  - 2. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 5. To Light Steel: Sheet metal screws.
- 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not support electrical equipment and conduit raceways from the building roof deck system. Electrical equipment raceways shall be supported directly from the building structural steel or from additional angles and channels which are secured to the building structural steel.

# 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS D1.1/D1.1M.
- C. Provide fabricated supports for all distribution equipment and other equipment, (including, but not limited to: motor controllers, variable frequency drives, temperature control panels, wiring devices, miscellaneous enclosures, disconnect switches, etc.) where required and/or indicated. Secure support structures to the floor at the bottom, and to the building structure at the top.

# 3.4 INSTALLATION OF SEISMIC-RESTRAINT COMPONENTS

- A. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Restraint Cables: Provide slack within maximums recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

# 3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

# 3.6 PAINTING

- A. Touch-up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching-up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- B. Touch-up: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, multi-function floor boxes, fire rated pole-thru devices and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 07 Section "Penetration Firestopping" for firestopping materials and installation.
  - 2. Division 26 Section "Hangers & Supports for Electrical Systems" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
  - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.
  - 4. Division 27 Section "Structured Voice & Data Cabling System".

## 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. RNC: Rigid nonmetallic conduit.

### 1.4 SUBMITTALS

- A. Product Data:
  - 1. wireways and fittings,
  - 2. Hinged-cover enclosures, and
  - 3. Multifunction floor boxes.
  - 4. Fire rated pole thru devices.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## 1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, floor boxes, poke-thru devices and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 METAL CONDUIT AND TUBING

- A. Available Manufacturers:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 4. Electri-Flex Co.
  - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 6. LTV Steel Tubular Products Company.
  - 7. Manhattan/CDT/Cole-Flex.
  - 8. O-Z Gedney; Unit of General Signal.
  - 9. Wheatland Tube Co.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. EMT and Fittings: ANSI C80.3.
  - 1. Fittings: Compression type or steel set-screw type. (Die cast set screw type will not be acceptable).
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

# 2.3 NONMETALLIC CONDUIT

- A. Available Manufacturers:
  - 1. Certainteed Corp.; Pipe & Plastics Group.
  - 2. Electri-Flex Co.
  - 3. Lamson & Sessions; Carlon Electrical Products.
  - 4. Manhattan/CDT/Cole-Flex.
  - 5. RACO; Division of Hubbell, Inc.
  - 6. Spiralduct, Inc./AFC Cable Systems, Inc.
  - 7. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- D. LFNC: UL 1660.

## 2.4 METAL WIREWAYS

- A. Manufacturers:
  - 1. Hoffman.
  - 2. Square D.
  - 3. General Electric
  - 4. Thomas & Betts
- B. Material and Construction: Sheet metal sized and shaped as indicated and/or required.
  - 1. Indoor, dry locations: NEMA 1.
  - 2. Outdoor or wet locations: NEMA 3R.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Hinged type.
- F. Finish: Manufacturer's standard enamel finish.

## 2.5 BOXES AND ENCLOSURES

- A. Available Manufacturers:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. Emerson/General Signal; Appleton Electric Company.
  - 3. Erickson Electrical Equipment Co.
  - 4. Hoffman.
  - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - 6. O-Z/Gedney; Unit of General Signal.

- 7. RACO; Division of Hubbell, Inc.
- 8. Robroy Industries, Inc.; Enclosure Division.
- 9. Scott Fetzer Co.; Adalet-PLM Division.
- 10. Spring City Electrical Manufacturing Co.
- 11. Thomas & Betts Corporation.
- 12. Walker Systems, Inc.; Wiremold Company (The).
- 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

## 2.6 FACTORY FINISHES

A. Finish: For wireway or enclosure, components, provide manufacturer's standard paint applied to factory-assembled wireways and enclosures before shipping.

# 2.7 MULTI-SERVICE FLOOR BOXES

A. See contract drawings for requirements.

# PART 3 - EXECUTION

- 3.1 RACEWAY APPLICATION
  - A. Outdoors:
    - 1. Exposed: Rigid steel.
    - 2. Concealed: Rigid steel.
    - 3. Underground, Single Run or grouped (600V and less): Rigid steel, RNC., or RNC encased within reinforced concrete ductbank where indicated on the Contract Drawings.
    - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
    - 5. Boxes and Enclosures: NEMA 250, Type 3R.
  - B. Indoors:
    - 1. Exposed within mechanical and electrical rooms: Rigid Steel, IMT or EMT.
    - 2. Concealed (600V and below): EMT.
    - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
    - 4. Damp or Wet Locations: Rigid steel conduit.
    - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

- a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

# 3.2 INSTALLATION

- A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal conduit and EMT within finished walls and ceilings, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Raceways <u>shall not</u> be embedded within concrete floor slabs or within concrete on top of metal floor pan construction.
  - 1. Conduits <u>shall not</u> be installed embedded within concrete floors.
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
  - 1. Use insulating bushings to protect conductors.
- K. Tighten set screws of threadless fittings with suitable tools.
- L. Terminations:
  - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

- 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- M. Install pull wires in all raceways left empty as part of this contract. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- N. Telephone and Signal System Raceways: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Provide bushings on ends of conduits for protection on low voltage cables.
  - 1. Raceway and Outlet Box Requirements for work area (voice, data and combination voice & data) outlets:
    - a. Conduit and raceway systems at work area outlets shall consist of the following:
      - 4" square, 2-3/4 inch deep outlet box with one-inch EMT conduit from outlet box to nearest accessible ceiling cavity, within finished areas. In areas where there is an exposed ceiling, provide conduit raceway systems from work area outlet box to the voice/data equipment rack and/or plywood backboard.
        - a) Provide separate 1" conduit raceway systems for voice and data systems where cable is routed from an accessible ceiling cavity space through an exposed ceiling space, to the voice plywood backboard and to the data system equipment rack.
      - 2) All conduit ends shall be provided with protective bushings to protect cables during installation.
      - Outlet box shall be provided with double-gang plaster ring for mounting of device plates. Wall mount phone locations shall be provided with a singlegang plaster ring.
- O. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor.
- P. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
  - 1. It shall be acceptable to use MC type Cable for the fixture whips (72 inches maximum length).
- Q. Install hinged-cover enclosures plumb. Support at each corner.
- R. Raceways shall be dedicated to conductors from one panel.

- 1. Raceways shall not be shared by two panels. The branch circuit conductors from one panel <u>shall not</u> be installed within the same raceway as branch circuit conductors from another panel.
- S. Seal interior of conduit at exterior entries, condensing units, etc. where the temperature differential can potentially be greater than 20 deg. F, to prevent moisture penetration. The seal shall be placed where fittings shall be a drain/seal, with sealing compound equal to OZ/Gedney type EYD.
- T. Provide multi-service floor boxes with all required accessories as required for proper installation and as required to provide services as indicated on the contract drawings. Install per manufacturer's recommended installation requirements.

# 3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

# 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. See Division 26 Section "Common Work Results for Electrical", for sleeve installation requirements.

# 3.5 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL AND COMMUNICATION SYSTEMS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
  - 2. Handholes and boxes.

### 1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Duct-bank materials, including separators and miscellaneous components.
  - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  - 3. Handholes and accessories for handholes and boxes.
  - 4. Warning tape.
- B. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
  - 1. Duct entry provisions, including locations and duct sizes.
  - 2. Cover design.
  - 3. Grounding details.
  - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- 1.5 QUALITY ASSURANCE
  - A. Comply with ANSI C2.
  - B. Comply with NFPA 70.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

# 1.7 COORDINATION

- A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions.

# PART 2 - PRODUCTS

# 2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

# 2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ARNCO Corp.
  - 2. Beck Manufacturing.
  - 3. Cantex, Inc.
  - 4. CertainTeed Corp.; Pipe & Plastics Group.
  - 5. Condux International, Inc.
  - 6. ElecSys, Inc.
  - 7. Electri-Flex Company.
  - 8. IPEX Inc.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Manhattan/CDT; a division of Cable Design Technologies.
  - 11. Spiraduct/AFC Cable Systems, Inc.

# 2.3 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. See Contract Drawings for requirements.

# PART 3 - EXECUTION

## 3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concreteencased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.
- C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank, unless otherwise indicated.

## 3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
  - 1. See Contract Drawings for requirements.

## 3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavyduty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

### 3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- E. Concrete-Encased Ducts: Support ducts on duct separators.

- Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
- 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
  - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
  - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
- 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
- 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
- 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
- 6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
- 7. Depth: Install top of duct bank at least 30 inches below finished grade, unless otherwise indicated.
- 8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
- 9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
- 10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.
- F. Direct-Buried Duct Banks:
  - 1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

- 2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
- 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
- 4. Install backfill as specified in Division 31 Section "Earth Moving."
- 5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
- 6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
- 7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
- 8. Set elevation of bottom of duct bank below the frost line.
- 9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
- 10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

# 3.5 INSTALLATION OF HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
  - 1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
  - 2. Dimensions: 10 inches wide by 12 inches deep.
- H. See Contract Drawings for additional installation requirements.

# 3.6 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

# SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Identification for conductors and communication and control cable.
  - 2. Underground-line warning tape.
  - 3. Warning labels and signs.
  - 4. Instruction signs.
  - 5. Equipment identification labels.
  - 6. Miscellaneous identification products.
  - 7. Conductor color coding

# 1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

## 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

- 2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS
  - Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 Α. to 2 inches wide.
  - Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification Β. legend machine printed by thermal transfer or equivalent process.
  - Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester C. or nylon tie for attachment to conductor or cable.
    - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

#### 2.2 UNDERGROUND-LINE WARNING TAPE

- Description: Permanent, bright-colored, continuous-printed, polyethylene tape. Α.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - Embedded continuous metallic strip or core. 3.
  - Printed legend shall indicate type of underground line. 4.

#### 2.3 WARNING LABELS AND SIGNS

- Comply with NFPA 70 and 29 CFR 1910.145. Α.
- Β. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-D. acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- Ε. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD -EQUIPMENT HAS MULTIPLE POWER SOURCES." Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT
  - 2. OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

# 2.4 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

# 2.5 EQUIPMENT IDENTIFICATION LABELS

- A. Indoor Areas: Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Minimum letter height shall be 3/8 inch. Colors shall be as follows:
  - 1. Normal Power System. Black letters on white background.
- B. Outdoor Areas: Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

# 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# PART 3 - EXECUTION

# 3.1 APPLICATION

- A. Empty conduits and raceway systems. Blank conduit ends or outlet boxes for future extension of system shall have a permanent identification marker indicating the purpose of the conduit, box, or raceway system. The marker shall also identify where the raceway originates.
- B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.
- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, and intercommunications connections.

- 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground line warning tape for direct buried cables, cables in raceway and concrete enclosed raceways.
- F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- G. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with Contract Drawings, wiring diagrams, schedules, and Operation and Maintenance Manual. Labels on distribution equipment shall include equipment nomenclature, source of feed and system voltage. Provide labels for the following equipment:
  - 1. Distribution panels
  - 2. Branch circuit panels
  - 3. Disconnect switches
  - 4. Enclosed circuit breakers
  - 5. Individual Motor controllers
  - 6. Fire alarm system panels
  - 7. Variable speed motor controllers
  - 8. Temperature control panels
  - 9. Lighting control panels
  - 10. Lighting Contactors
  - 11. Individual over-current protection devices within:
    - a. Distribution panels
  - 12. Labeling Instructions:

- a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
- b. Outdoor Equipment: Stenciled legend 4 inches high.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

# 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Colors shall be factory applied. Use the colors listed below for all feeder and branch-circuit conductors.
  - 1. Colors for 208/120V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C:
    - d. Neutral: White
    - e. Ground: Green
    - f. Isolated Ground: Green with yellow stripes
  - 2. Colors for 480Y/277V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange
    - c. Phase C: Yellow
    - d. Neutral: Gray
    - e. Ground: Green
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous undergroundline warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- H. Painted Identification: Prepare surface and apply paint according to Division 09 Painting Sections.

SECTION 260923 - LIGHTING CONTROL DEVICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Outdoor photo-electric switches.
  - 2. Lighting control panels.
  - 3. Occupancy sensors.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for manual light switches.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Interconnection diagrams showing field-installed wiring.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

## 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. All equipment shall be UL listed.

## 1.5 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with all other construction that penetrates ceilings or is supported by them, including but not limited to, lighting fixtures, HVAC equipment, smoke detectors, fire suppression system, and partition assemblies.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in the paragraphs below.

# 2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Conductors and Cables."
- B. Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 26 Section "Low Voltage Electrical Power Conductors and Cables"

## 2.3 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Area Lighting Research, Inc.; Tyco Electronics.
  - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
  - 3. Intermatic, Inc.
  - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 5. Square D; Schneider Electric
  - 6. Watt Stopper (The)
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA tungsten or 1000-VA inductive, to operate connected load, relay, or contactor coils; complying with UL 773.
  - 1. Light-level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx) with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
  - 4. Mounting: Twist lock complying with IEEE C136.10, with base and stem mounting or stem-and swivel mounting accessories as required to direct sensor to the north sky exposure.

# 2.4 LIGHITNG CONTROL PANELS

A. See Contract Drawings for requirements.

# PART 3 - EXECUTION

### 3.1 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be <sup>3</sup>/<sub>4</sub> inch.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

## 3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

### 3.3 LIGHTING CONTROL PANEL INSTALLATION

- A. Mount panels plumb with centers approximately 54" above finished floor.
- B. Seismically secure panels to building using methods as required by Division 26 Section "Vibration and Seismic Controls for Electrical Systems".
- C. Coordinate programming requirements with the Contract Drawings and the Owner's requirements. Verify Program settings with Owner and Engineer prior to final adjustments.

### 3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
- B. Label contactors lighting control panels, and time switches according to Division 26 Section "Identification for Electrical Systems" and with a unique designation as noted on the contract drawings.

# 3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing and after electrical circuitry has been energized, test for compliance with requirements.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

# 3.6 ADJUSTING

- A. Occupancy Adjustments: Adjust occupancy sensors to settings as directed by Owner and reviewed by Engineer.
  - 1. Coordinate requirements with Owner and Engineer prior to installation.
  - 2. Provide a minimum of one re-adjustment of all sensors within each space as required by the Owner after occupancy.

# 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training".

SECTION 262110 – DIGITAL MULTIFUNCTION POWER MONITORING SYSTEMS

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

# 1.2 SUMMARY

- A. This Section includes digital multifunction power monitoring equipment for use by the Owner in monitoring energy use, peak demand, power quality, and other parameters.
- B. Related Sections: The following sections contain requirements that relate to this section.
  - 1. Division 26 Section "Hangers and Supports for Electrical Systems".
  - 2. Division 26 Section "Panelboards".
  - 3. Division 26 Section "Switchboards"
  - 4. Division 26 Section "Transfer Switches (600V and Less)".

# 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
  - 1. Multifunction power monitoring equipment and accessories.
- B. Shop Drawings for power monitoring equipment and accessories: Include the following:
  - 1. Dimensioned plans and sections or elevation layouts.
  - 2. Wiring Diagrams: Power, signal, control, and communication wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
  - 3. Mounting and anchoring devices recommended by manufacturer to resist seismic forces specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For power monitoring equipment to be included in the emergency, operation, and maintenance manuals.

# 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Warranty: The Monitor shall have a standard 4-year warranty.
  - 1. Refer to Division 01 Sections for additional requirements on start of warranty period.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers.
  - 1. General Electric,
  - 2. Square D
  - 3. Eaton-Cutler-Hammer
  - 4. Siemens

## 2.2 DESCRIPTION

- A. The Monitor shall provide Continuous Monitoring of power distribution system.
- B. Monitoring capabilities shall include:
  - 1. Current (la, lb, lc, ln)
  - 2. Voltage (Va, Vb, Vc, Vab, Vbc, Vca)
  - 3. VI unbalance
  - 4. TRUE Power Factor Crest and K Factor
  - 5. Frequency
  - 6. KW
  - 7. KVA
  - 8. KVAR
  - 9. Energy Use (KWH, KVAH, KVARH, Cost of Power)
  - 10. Peak Demand Use (A, KW, KVAR, KVA)
- C. Communication Capability. Unit shall be provided with two RS 485 ModBus ports, and accessories as required for Ethernet communications.
- D. The Monitor shall use non-volatile flash memory for firmware storage, to allow for future product upgrades to be loaded via the serial port.
- E. The Monitor shall be capable of being used as a stand alone unit, or as part of an integrated system of monitoring.

- F. The monitor shall be provided with software for installation on an owner furnished personal computer to allow owner the ability to change system set points and monitor values, status and alarms, and to download historical data recorded by the Monitor.
- G. The monitor shall be provided with capability for the following items:
  - 1. Data logging (Trending)
  - 2. Harmonic Analysis
  - 3. Wave Form Capture
  - 4. Even Recorder
- H. CT's shall be split-core type to allow for installation or removal without disconnection of feeder conductors. CT's shall be rated as required for correct operation with meter and feeders indicated.

# PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Provide metering at all locations indicated on the Contract Drawings.
  - 1. All metering equipment indicated on distribution switchboards, distribution panelboards and transfer switches shall be furnished as part of the distribution equipment by the manufacturer of the distribution equipment.
- B. Provide all required materials and labor and interconnect meters with the building management system as required for correct operation.
  - 1. Provide programming of digital power quality meter as required for the BMS system to communicate with the meter.
- C. Provide all required materials and labor and inter connect meters with converters as required to allow for Ethernet communications. Provide Data Cable from (RS4B5 to Ethernet) converters to the building data network rack.

# 3.2 FIELD QUALITY CONTROL

- A. Test power monitoring equipment for proper operation, accuracy, and usability of output data.
  - 1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
  - 2. Turn off circuits supplied by metered feeder and secure them in off condition.
  - 3. Run test load continuously for two hours, minimum, or longer to obtain a measurable meter indication. Use test load placement and setting that ensures continuous, safe operation.
  - 4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at test load connection. Record test results.
  - 5. Repair or replace deficient or malfunctioning metering equipment, or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

# 3.3 POWER

A. Provide all required labor and material and provide power circuits (from the same emergency or normal power source) to the digital meter system as required for proper operation.

# 3.4 PROGRAMMING

A. Provide all labor and materials as required and provide factory authorized person to program meters for correct operation of displaying and reading parameters.

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA.
- B. Control and signal transformers.

### 1.3 REFERENCES

- A. NEMA ST 20 Dry Type Transformers for General Applications.
- B. ANSI/IEEE CC57.12.01 General Requirements for Dry Type Distribution and Power Transformers.
- C. ANSI/IEEE C57.12.91 Test Code for Dry Type Distribution and Power Transformers.
- D. NEMA TP1 Optimum Energy Efficiency Transformer Standards.
- E. NEMA TP2 Testing Procedures for Optimum Energy Efficiency Transformer Losses.

### 1.4 SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, voltage, KVA, impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, rated temperature rise, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.
- D. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field installed wiring.

- E. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Division 26 Section "Electrical Supports and Seismic Restraints". Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Source quality-control test reports.
- G. Output Settings Reports: Record of tap adjustments specified in Part 3.
- H. Warranties.

# 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."
- D. Energy-Efficient Transformers Rated 15 kVa and Larger: Certified as meeting NEMA TP1, Class 1 efficiency levels when tests according to NEMA TP2.

# 1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

# 1.7 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
  - 1. Refer to Division 26 Section "Hangers and Supports for Electrical Systems" for additional requirements.

# 1.8 WARRANTIES

- A. Manufacturer shall warrant transformers and all components and accessories against defects in materials and workmanship.
  - 1. Warranty Period: 2 years.
  - 2. See Division 01 Specifications for additional warranty requirements, including but not limited to, start of warranty period.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; Schneider Electric.
  - 2. General Electric.

# 2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Copper or Aluminum.

# 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Ventilated, NEMA 250, Type 2.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: Manufacturer's standard paint over corrosion-resistant pretreatment.
- F. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

- G. Taps for Transformers 3 to 25 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- I. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
  - 2. Tested according to NEMA TP 2.
- J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize inter-winding capacitance.
  - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
  - 2. Include special terminal for grounding the shield.
  - 3. Shield Effectiveness:
    - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
    - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
    - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- K. Insulation Class: 220 deg. C, UL-component recognized insulation system with a maximum of 150 deg. C rise above 40 deg. C ambient temperature.

## 2.4 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."
- 2.5 SOURCE QUALITY CONTROL
  - A. Test and inspect transformers according to IEEE C57.12.91.
- 2.6 CONTROL AND SIGNAL TRANSFORMERS
  - A. Description: Self-cooled, two-winding dry type, rated for continuous duty, complying with NEMA ST 1, and listed and labeled as complying with UL 506.
  - B. Ratings: Continuous duty. If rating is not indicated, provide at least 50 percent spare capacity above connected peak load.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- C. Identify transformers and install warning signs according to Division 26 "Identification for Electrical Systems".
- D. Tighten electrical connectors and terminals according to manufacturer's published torquetightening valves. If manufacturer's torque valves are not indicated, use those specified in UL 486A and UL 486B.

# 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Tests: Include the following minimum inspections and test according to manufacturer's written instruction. Comply with IEEE C57.12.91 for test methods and data correction factors.
  - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
  - 2. Inspect bolted electrical connections for tightness.

B. Remove and replace units that do not pass tests or inspections and retest as specified above.

# 3.5 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- B. Remove paint splatters and other spots, dirt and debris.
- C. Repair scratches and mars on finish to match original finish.
- D. Clean components internally using methods and materials recommended by manufacturer.

# 3.6 ADJUSTING

A. Record transformer secondary voltage at each unit during typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent.

SECTION 262413 - SWITCHBOARDS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Service and distribution switchboards, integral circuit breaker over-current protection devices, and integral surge suppression devices rated 600 V and less.
  - 2. Over-Current Protection Coordination Study and Circuit Breaker adjustments.
  - 3. Arc Flash Hazard Study & Arc Flash Hazard & Shock Hazard Labels.
- B. Related Sections: The following sections contain requirements that relate to this section.
  - 1. Division 26 Section "Hangers and Supports for Electrical Systems"

### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. SPD. Surge Protection Device
- G. Front-Accessible only shall be as defined by UL 891 standard which requires that all line and load connections for phase, neutral, and ground conductors can be made and maintained from the front of the switchboard without access to the rear.
- H. Isolated Vertical Cabinet Sections shall be as required to meet the NEC Article 700.10 requirements for separate vertical switchboard sections.

## 1.4 SUBMITTALS

- A. Product Data: For each type of switchboard, over-current protective device, surge protection device, ground-fault protector, power quality monitoring equipment, accessories, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of switchboards and over-current protective devices.
    - d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.
    - e. Descriptive documentation of isolated vertical switchboard sections.
    - f. Mimic-bus diagram.
    - g. UL Listing for series rating of installed devices.
    - h. Features, characteristics, ratings, trip curves, and factory settings of individual over-current protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring and differentiate between manufacturer's installed and field installed wiring.
  - 3. Arch flash and over-current protection study.
- C. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:
  - 1. Routine maintenance requirements for switchboards and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting over-current protective devices.
  - 3. Time-current curves, including selectable ranges for each type of over-current protective device.
- E. Over-Current Protection Coordination Study Report with recommended circuit breaker settings.
- F. Arc Flash Study Report & Labels.
- G. Warranty
### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain switchboards through one source from a single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. All equipment shall be UL listed and labeled.
- D. Comply with NFPA 70.

### 1.6 REFERENCES

- A. The low voltage switchboards and protection devices covered by this specification shall be designed and manufactured according to latest revision of the following standards (unless otherwise noted).
  - 1. ANSI/IEEE C12.16 Solid State Electricity Metering
  - 2. ANSI C57.13 Instrument Transformers
  - 3. ANSI/NEMA PB 2, Deadfront Distribution Switchboards
  - 4. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less
  - 5. ANSI/NEMA PB 2.2, Application Guide for Ground Fault Protective devices for Equipment.
  - 6. ANSI/NFPA 70, National Electrical Code
  - 7. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches
  - 8. UL 50 Cabinets & Boxes
  - 9. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures
  - 10. UL 891, Dead Front Switchboards
  - 11. UL 98, Enclosed and Dead Front Switches
  - 12. UL 943 Standard for Ground Fault Circuit Interrupters.
  - 13. Federal Specification W-C-375B/Gen Circuit Breakers, Molded Case, branch Circuit and Service.
- B. Voltage Surge Protection Devices. Voltage SPDs & systems shall be designed, manufactured, tested and labeled in accordance with the following standards:
  - 1. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits, Category C.
  - 2. ANSI/IEEE C62.45, Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
  - 3. UL 1449, Most Current Edition Surge Protection Devices.
  - 4. UL1283.
  - 5. NEMA LC-1 (1992), Low Voltage Surge Protective Devices.
  - 6. NEC Article 285.

- 1.7 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver in sections or lengths that can be moved past obstructions in delivery path.
  - B. Handle switchboards according to NEMA PB 2.1 and NECA 400.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of switchboards, over-current protection devices, and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. Switchboard, Over-Current Protection Devices, Metering, and Accessories: 2 years.
      - 1) See Division 01 specifications for additional warranty requirements including, but not limited to start of warranty period.
    - b. Surge Protection Devices: Five years. See Division 01 specifications for additional warranty requirements, including but not limited to, start of warranty period.

### 1.9 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Field Measurements. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03. Coordinate seismic design and restraints required for the switchboards with the requirements within Division 26 Section "Vibration and Seismic Controls for Electrical Systems".

# PART 2 - PRODUCTS

#### 2.1 OVERCURRENT COORDINATION STUDY

- A. Obtain the services of factory representatives to provide a comprehensive over-current coordination study for all new distribution system equipment. Provide results of this study in written report format. Include recommended circuit breaker settings.
  - 1. All new overcurrent protection devices shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.
  - 2. Provide the services of factory representatives to provide adjustments to the breakers to match the recommended settings in the Overcurrent coordination & Arc Flash Hazard studies.

## 2.2 ARC FLASH HAZARD & SHOCK HAZARD STUDY

- A. Obtain the services of factory representatives to provide a comprehensive Arc Flash and Shock Flash Hazard study. The study shall be based on the final circuit breaker adjustment settings made in the field and feeder circuit lengths as installed by the Electrical Contractor. The Arc Flash & Shock Hazard analysis shall be performed for all new distribution system equipment.
  - 1. Provide results of this study in written report format.
  - 2. Provide labels meeting the requirements of NFPA 70E 2015 Edition on all new distribution equipment (Switchboards, Switchgear, Distribution Panels, branch circuit panels, automatic transfer switches, enclosed switches and circuit breakers, motor controllers, transformers, and variable frequency drives).

### 2.3 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. Switchboards, Over-Current Protection, Surge Protection Devices, Power Monitoring equipment:
    - a. Square D
    - b. General Electric
    - c. Siemens
    - d. Cutler Hammer (Eaton)
  - 2. Loss-of-Phase Protection devices:
    - a. Time Mark Corporation
    - b. Diversified Electronics

### 2.4 SWITCHBOARD – GENERAL

- A. Short Circuit Current Rating: Switchboards shall be rated with a minimum short circuit current rating (rms symmetrical amperes) available at the switchboard locations (as determined by the over-current coordination and arc flash study) and voltages as indicated on the Contract Drawings.
- B. Future Provisions: All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
- C. Enclosures shall be appropriate for installed locations.
  - 1. Sections shall be aligned front and rear.
  - 2. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
  - 3. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
  - 4. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
  - 5. Top and bottom conduit areas shall be clearly indicated on shop drawings.

- 6. Front accessible only type switchboards shall be provided where the Contract Drawings indicate the switchboard is to be installed the back of switchboard up against the wall.
- D. Nameplates: Provide 1 inch high x 3 inches engraved laminated (Gravoply) nameplates for each device. See Division 26 Section Identification for Electrical Systems for label and letter colors and additional labelling requirements.
- E. Bus Composition: Shall be plated copper or plated aluminum. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the Contract Drawings. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.
- F. Bus Connections: Shall be bolted with Grade 5 bolts and conical spring washers.
- G. Ground Bus: Sized per NFPA70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.
- H. Accessibility: (See Contract Drawings and installation locations for front & back vs. front only accessibility requirements).

# 2.5 SWITCHBOARD – INCOMING MAIN SECTION DEVICES

- A. Two-step stored energy electronic trip molded case circuit breaker(s).
  - 1. Circuit protective devices shall be two-step stored energy type circuit breakers.
  - 2. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
  - 3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.
  - 4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.
    - a. Long Time Pickup & Long Time Delay
    - b. Short Time Pickup & Short Time Delay (I<sup>2</sup>t IN & I<sup>2</sup>t OUT)
    - c. Instantaneous Pickup
    - d. Ground Fault Pickup & Ground Fault Delay (I<sup>2</sup>t IN and I<sup>2</sup>t OUT)
    - e. Ground Fault Alarm Only Pickup
  - 5. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
  - 6. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True rms with 2% accuracy.
  - 7. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

- 8. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
- 9. All circuit breakers shall be equipped with all required electrical accessories and additional accessories as indicated on the Contract Drawings.
- 10. Equipment Ground Fault Protection
  - a. Circuit breaker(s) shall be provided with integral equipment protection for grounded systems (Normal Power Distribution Systems Only).
  - b. The ground fault system shall be of the residual type.
- 11. Terminations
  - a. All lugs shall be UL Listed to accept solid and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the NEC.
  - b. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs.

# 2.6 SWITCHBOARD – DISTRIBUTION SECTION DEVICES

- A. Group mounted circuit breakers through 1200A
  - 1. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
  - 2. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.
  - 3. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.
  - 4. Line-side circuit breaker connections are to be jaw type.
  - 5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
  - 6. Electronic trip molded case full function 100% rated circuit breakers.
    - a. All electronic circuit breakers shall have the following time/current response adjustments:
      - 1) Long Time Pickup, Long Time Delay,
      - 2) Short Time Pickup,
      - 3) Short Time Delay,
      - 4) Instantaneous settings
      - 5) Ground Fault Pickup (Normal Power Distribution Only),
      - 6) Ground Fault Delay (Normal Power Distribution Only),
      - 7) Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
    - b. Local visual trip indication for overload, short circuit and ground fault trip occurrences.

- c. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
- d. Furnish thermal magnetic molded case circuit breakers for 250A frames and below, unless noted otherwise on the Contract Drawings.
- 7. Thermal magnetic molded case circuit breakers.
  - a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.
  - b. Circuit protective devices shall be molded case type circuit breakers with minimum interrupting ratings as indicated on the Contract Drawings.
  - c. Manufacturer shall submit one set of published Ip and I<sup>2</sup>t let-through curves (as required by UL) to the owner.

# 2.7 MIMIC BUS

- A. Show the entire single line switchboard bus work, as depicted on the factory record drawing, on an engraved laminated plastic (Gravoply) nameplate. The nameplate shall be at least .0625 inch thick and located at eye level on the front cover of the switchboard incoming service section.
- 2.8 SURGE PROTECTION DEVICES (SPDs)
  - A. Refer to Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.
  - B. Electrical Requirements:
    - 1. System voltage shall as indicated on drawings.
    - 2. The SPDs shall be UL tested and labeled as a complete assembly to a symmetrical fault current rating greater than or equal to the rating of the connected panel, in accordance with NEC Article 285 without the requirement of a dedicated breaker feeder to obtain the fault current withstand rating.
    - 3. The Suppression Voltage Rating (SVR) shall be tested with the integral disconnect in accordance with UL-1449, Latest Edition. The UL SVR values shall not exceed with following (including disconnect).

Configuration	L-N	N-G	L-G
Grounded Wye	400	400	400
Grounded Wye	800	800	800
	Configuration Grounded Wye Grounded Wye	ConfigurationL-NGrounded Wye400Grounded Wye800	ConfigurationL-NN-GGrounded Wye400400Grounded Wye800800

- C. Operating Conditions:
  - 1. Operating Frequency: 60 Hz.
  - 2. Temperature: minus 40 deg. C to plus 60 deg. C.
  - 3. Humidity: 95 percent relative humidity, non-condensing atmosphere.
  - 4. Operating Altitude: 0 12,000 ft.
  - 5. Seismic: See Division 26 Section "Hangers and Supports for Electrical Systems".
- D. Internally Generated Environmental Influence:

- 1. Audible Noise: No Audible Noise
- 2. Surface Temperature: less than 55 deg. C.
- E. Protection and Filtering Elements:
  - 1. The SPDs shall have a maximum surge current rating of:
    - a. Service Entrance: 120kA per mode / 240kA per phase.
    - b. Distribution Switchboards: 100kA per mode / 200kA per phase.
    - c. Devices that derive a maximum surge current rating by adding test results of individual components are not acceptable.
  - 2. The SPD device repetitive surge current capacity shall be tested utilizing a 1.2x50's, 20kV open circuit voltage, 8x20's, 10kA short circuit Category C3 test wave form (as defined by ANSI/IEEE C62.41 1991 and ANSI/IEEE C62.45 1992) at one minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. The service entrance device shall be capable of surviving a minimum of 20,000 C3 impulses without failure or performance degradation of more than 10%. Downstream devices shall be capable of surviving a minimum of 5,000 C3 impulses without failure or performance degradation of more than 10%.
  - 3. The SPD device shall be capable of surviving a minimum of 5,000 surges using a 10x1000's impulse (1kV, 4kV for 277/480V devices, .5kV, 2kV for 120/280V devices), confirmed by an independent nationally recognized test lab (R & B Labs).
  - 4. Systems using selenium, gas tubes or silicon avalanche diodes in surge current path are not acceptable.
  - 5. The Maximum Continuous Operating Voltage (MCOV) for all voltage configurations shall be 115% of nominal or greater.
  - 6. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that open below the maximum surge current level are unacceptable. The fusing system shall be included in the surge current testing.
- F. Standard Monitoring Features:
  - 1. Operational status indicating lights.
  - 2. Audible alarm and alarm indicating light and test switch.
  - 3. Dry contacts for remote monitoring purposes.
  - 4. Surge counter.
- G. Surge Protection device shall include an integral disconnect switch which has been tested to the surge current rating of the SPD and match or exceed the fault current rating of the board per NEC 285. The Disconnect must switch the phases and neutral. Use of circuit breakers for disconnect mean is not acceptable due to impedance and the requirement for neutral disconnect. The SPD shall be mounted integral to the switchboard and installed at the switchboard manufacturer's assembly plant.

# 2.9 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
  - 1. Potential Transformers: Secondary voltage rating of 120V and NEMA accuracy class of 0.3 with burdens of W, X, and Y. Transformers shall be disconnecting type with integral

fuse mountings and primary/secondary ratio as required for connected metering and relay devices.

- 2. Current Transformers: Ratios shall be as indicated or required with accuracy class and burden suitable for connected relays, meters, and instruments.
- 3. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondaries to ground over-current relays to provide selective tripping of main, tie, and feeder circuit breakers.

# 2.10 GROUND FAULT PROTECTION.

A. Trip settings of ground fault protection on main circuit breakers (480Y/277V 1000A or higher rating) shall be field set by the equipment manufacturer's authorized personnel and shall be set to the maximum fault current allowed by the National Electrical Code.

# 2.11 CONTROL POWER

- A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.
- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No.8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

# PART 3 - EXECUTION

# 3.1 LABELS

- A. Provide Arc Flash Hazard & Shock Hazard labels on all removable equipment panels (i.e. front, sides, and back (if accessible) in accordance with NEC requirements.
- B. Provide labels on equipment in accordance with the requirements of Division 26 Section "Identification for Electrical Systems".
  - 1. Main Distribution Switchboards: In addition to the labelling requirements of Division 26 Section "Identification for Electrical Systems", main distribution switchboards shall also be provided with the following labels:
    - a. Fed From transformer #\_\_ located on \_\_\_\_\_ side of building).
    - b. Available Fault Current at the Transformer Secondary.
    - c. Date of Install (Month/Day/Year) and date when the available fault current was calculated.

#### 3.2 EXAMINATION

A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.3 INSTALLATION

- A. Install switchboards and accessories according to manufacturer's written guidelines, the NEC, and local codes and the requirements of the local authorities having jurisdiction.
- B. Provide seismic reinforced and secured concrete housekeeping pad beneath all floor mounted equipment. Seismic housekeeping pads shall be designed to withstand seismic forces as described within Division 26 Section "Vibration and Seismic Controls for Electrical Systems".
- C. Install and anchor switchboards level on seismic concrete housekeeping pads.
- D. Provide all circuits and terminations as required between the Energy & Resource Metering system equipment and the building management system equipment as required to allow building management system to communicate with the power monitoring equipment.
- E. Set field-adjustable circuit-breaker trip ranges to values as recommended in the Over-Current Coordination Study.
  - 1. Include setting adjustments for multiple levels of ground fault protection.

#### 3.4 FIELD QUALITY CONTROL

- A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- B. Perform inspections and testing in accordance with the equipment manufacturer's written recommendations & requirements.
- C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.
- D. Test key interlock systems to ensure proper function.
- E. Test function of all circuit breakers and accessories. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- F. Test ground fault system by operating push-to-test buttons.
- G. Test power monitoring equipment for proper operation, accuracy, and usability of output data.
  - 1. Verify the meter(s) are reading correct parameters.
  - 2. Repair or replace deficient or malfunctioning metering equipment, or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

# 3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards.
  - 1. Remove paint splatters and other spots.
  - 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
  - 3. Repair exposed surfaces to match original finish.

# 3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, over-current protective devices, instrumentation, and accessories.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### 1.3 REFERENCES

- A. NEMA AB 1 Molded Case Circuit Breakers.
- B. NEMA KS 1 Enclosed Switches
- C. NEMA PB 1 Panelboards
- D. NEMA PB 1.1 Instructions for safe Installation, operation and Maintenance of Panelboards rated 600V or Less.
- E. NEMA PB 1.2 Application Guide for Ground-fault Protective Devices for Equipment.
- F. ANSI/IEEE C62.41 Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits, Category C.
- G. ANSI/IEEE C62.45 Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.
- H. UL1449, Current Edition Transient Voltage Surge Suppressors.
- I. UL 1283.
- J. NEMA LS-1m Low Voltage Surge Protective Devices.

#### 1.4 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.

- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient Voltage Surge Protection.

# 1.5 SUBMITTALS

- A. Product Data: For each type of panelboard, over-current protective device, transient voltage surge suppression equipment, power & energy meters and CTS, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and over-current protective devices.
    - d. Features, characteristics, ratings, and factory settings of individual over-current protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Hangers and Supports for Electrical Systems." Include the following:
  - 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards.

- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section " Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting over-current protective devices.
  - 2. Time-current curves, including selectable ranges for each type of over-current protective device.
- G. Warranty.

# 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, over-current protective devices, components, and accessories through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

# 1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

# 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Six spares for each type of panelboard cabinet lock.

# 1.9 WARRANTY

- A. Manufacturer's Standard Form in which manufacturer agrees to repair or replace components of panelboards, over-current protection devices, and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. Panelboard, over-current protection devices and accessories.
      - 1) Two Years.
    - b. TVSS Devices: 5 years.

- c. See Division 01 Specifications for additional warranty requirements.
- d. Start of warranty period shall be at substantial completion.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Over-current Protective Devices, and Accessories:
    - a. General Electric Co.; Electrical Distribution & Protection Div.
    - b. Square D.
    - c. Eaton Corp; Cutler Hammer Products
    - d. Siemens Energy & Automation, Inc.

### 2.2 RATINGS

- A. Definitions:
  - 1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. Refer to Division 26 Section "Identification for Electrical Systems" for additional requirements.
  - 2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall be capable of carrying a minimum of the AIC rating that is specified.
- B. The panelboards for this project shall be fully rated unless otherwise specifically noted on the Contract Drawings or Specifications.
  - 1. AIC ratings shall be as indicated on the Contract Drawings. If ratings are not indicated, then the panelboards shall be rated for the available fault current at the point of connections to the distribution system.

# 2.3 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Hangers and supports for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
  - 1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.
    - b. Indoor Locations: NEMA 250, Type 1
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

- 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  - a. Provide with hinged front covers where specified or noted.
- 4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
- 5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- 6. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
  - 1. Material (Phase Buses): Hard-drawn copper, 98 percent conductivity or Tin Plated Aluminum.
  - 2. Material (Equipment Ground Bus): Copper of adequate size for feeder and branch-circuit equipment ground conductors; bonded to box.
  - 3. Isolated Equipment Ground Bus: Copper of adequate size for branch-circuit equipment ground conductors; insulated from box.
- D. Conductor Connectors: Suitable for use with conductor material.
  - 1. Main and Neutral Lugs: Mechanical type.
  - 2. Ground Lugs and Bus Configured Terminators: Compression type.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

# 2.4 DISTRIBUTION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Hinged Front Covers.
- C. Main Over-current Protective Devices: Circuit breaker, as indicated on Contract Drawings.
- D. Branch Over-current Protective Devices: Bolt-on circuit breakers.

#### 2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Over-current Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- C. Hinged Front Covers.

## 2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
  - 3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.
  - 4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Multi-pole units enclosed in a single housing or factory-assembled to operate as a single unit.

# 2.7 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES

- A. Refer to Drawings for actual layout and location of equipment and components; current ratings of devices, bus bars, and components; voltage ratings of devices, components and assemblies; and other required details.
- B. Electrical Requirements:
  - 1. System voltage shall as indicated on drawings.
  - 2. The TVSS shall be UL tested and labeled as a complete assembly to a symmetrical fault current rating greater than or equal to the rating of the connected panel, in accordance with NEC Article 285 without the requirement of a dedicated breaker feeder to obtain the fault current withstand rating.
  - 3. The Suppression Voltage Rating (SVR) shall be tested with the integral disconnect in accordance with UL-1449, Second Edition. The UL SVR values shall not exceed with following (including disconnect). If the device is remote mounted it shall be fed by a circuit breaker and the UL SVR rating shall include the breaker in series with the TVSS.

Nominal Voltage	Configuration	L-N	N-G	L-G
208/120V	Grounded Wye	400	400	700
480Y/277V	Grounded Wye	800	800	800

- C. Operating Conditions:
  - 1. Operating Frequency: 60 Hz.
  - 2. Temperature: minus 40 deg. C to plus 60 deg. C.
  - 3. Humidity: 95 percent relative humidity, non-condensing atmosphere.
  - 4. Operating Altitude: 0 12,000 ft.
  - 5. Seismic: See Division 26 Section "Hangers & Supports for Electrical Systems".
- D. Internally Generated Environmental Influence:
  - 1. Audible Noise: No Audible Noise
  - 2. Surface Temperature: less than 55 deg. C.
- E. Protection and Filtering Elements:
  - 1. The TVSS shall have a maximum surge current rating of:
    - a. Branch Circuit Panels: 65kA per mode / 130kA per phase.
    - b. Distribution Panels: 100kA per mode / 200kA per phase.
    - c. Devices that derive a maximum surge current rating by adding test results of individual components are not acceptable.
  - 2. The TVSS device repetitive surge current capacity shall be tested utilizing a 1.2x50's, 20kV open circuit voltage, 8x20's, 10kA short circuit Category C3 test wave form (as defined by ANSI/IEEE C62.41 1991 and ANSI/IEEE C62.45 1992) at one minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. The service entrance device shall be capable of surviving a minimum of 20,000 C3 impulses without failure or performance degradation of more than 10%. Downstream devices shall be capable of surviving a minimum of 5,000 C3 impulses without failure or performance degradation of more than 10%.
  - 3. The TVSS device shall be capable of surviving a minimum of 5,000 surges using a 10x1000's impulse (1kV, 4kV for 277/480V devices, .5kV, 2kV for 208Y/120V devices), confirmed by an independent nationally recognized test lab (R & B Labs).
  - 4. Systems using selenium, gas tubes or silicon avalanche diodes in surge current path are not acceptable.
  - 5. The Maximum Continuous Operating Voltage (MCOV) for all voltage configurations shall be 115% of nominal or greater.
  - 6. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that open below the maximum surge current level are unacceptable. The fusing system shall be included in the surge current testing.
- F. Standard Monitoring Features:
  - 1. Operational status indicating lights.
  - 2. Audible alarm and alarm indicating light and test switch.
  - 3. Dry contacts for remote monitoring purposes.
  - 4. Transient voltage surge counter.
- G. Equipment Mounting.
- H. The TVSS device shall include an integral disconnect switch which has been tested to the surge current rating of the TVSS and match or exceed the fault current rating of the board per NEC

285. The Disconnect must switch the phases and neutral. Use of circuit breakers for disconnect mean is not acceptable due to impedance and the requirement for neutral disconnect. The TVSS shall be mounted integral to the panelboard and installed at the panelboard manufacturer's assembly plant.

# PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems".
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install over-current protective devices.
  - 1. Set field-adjustable circuit-breaker trip ranges. Coordinate required settings with Engineer prior to Owner occupancy of building.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

# 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted with corrosion-resistant screws in accordance with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".

#### 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

# 3.4 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers.
- B. Load Balancing: After Substantial Completion, but not more than 30 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

# 3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Single and duplex receptacles, including:
    - a. Ground-fault circuit interrupters,
    - b. Isolated ground
  - 2. Single- and double-pole snap switches
  - 3. Device wall plates.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch circuit conductor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Product data shall include:
  - 1. Configurations, finishes, dimensions, and manufacturer's instructions.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

# 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Hubbell Incorporated
    - b. Leviton Mfg. Company Inc.
    - c. Pass & Seymour

#### 2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Duplex NEMA 5-20R. Simplex type receptacles shall be the same quality as the duplex receptacles specified below.
  - 1. Heavy-Duty grade, Specification Grade:
    - a. Hubbell HBL5352 Series
    - b. Leviton 5362 Series
    - c. Pass & Seymour 5362 Series
  - 2. GFCI Receptacles: Straight blade, feed-through type, heavy duty specification grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943, Class A, and include a status indicator light. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.
    - a. Hubbell GF8300 Series
    - b. Leviton 6898-HG Series
    - c. Pass & Seymour 2094-HG Series

# 2.3 SPECIAL RECEPTACLES

- A. Special Receptacles shall be of configuration as noted on Contract Drawings and shall be Heavy Duty Industrial Grade.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell.
    - b. Leviton.
    - c. Pass & Seymour.

# 2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulate grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

# 2.5 SWITCHES

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches: Heavy-Duty grade, quiet type, 120/277V operation.
  - 1. Single Pole:
    - a. Hubbell HBL1221 Series
    - b. Leviton 1221-2 Series
    - c. Pass & Seymour PS20AC1Series
  - 2. Double Pole:
    - a. Hubbell HBL1222 Series
    - b. Leviton 1222-2 Series
    - c. Pass & Seymour PS20AC2 Series
  - 3. Three-Way:
    - a. Hubbell HBL1223 Series
    - b. Leviton 1223-2 Series
    - c. Pass & Seymour PS20AC3 Series
  - 4. Four-Way:
    - a. Hubbell HBL1224 Series
    - b. Leviton 1224-2 Series
    - c. Pass & Seymour PS20AC4 Series

## 2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch thick,.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Wet Locations: Cast aluminum with cover, and listed and labeled for use in "wet locations while-in-use."

# 2.7 FINISHES

- A. Color: Wiring Device catalog numbers in Section text do not designate device color.
  - 1. Wiring Devices:
    - a. Devices connected to the normal power system shall be gray with stainless steel faceplates.

#### PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Arrangement of Devices: Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Ground adjacent switches under single, multi-gang wall plates.
  - 1. In locations where receptacles are located near voice, data, video, or other type of outlet box, arrange outlets such that outlet boxes are neatly grouped in the same area and installed at the same height maximum spacing between adjacent outlets shall be 6 inches.
  - 2. In locations where wiring devices are shown to be installed above countertops, or within cabinets or casework, coordinate the exact outlet box mounting height and installation with architectural elevation details and approved shop drawings for countertops, cabinets and casework. Arrange outlets such that outlet boxes are neatly grouped in the same area and installed at the same height.
- C. Remove wall plates and protect devices and assemblies during painting.
- D. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- E. Ground Fault Circuit Interrupter Receptacles.
  - 1. In general, "wet" areas, as defined by the NEC, shall be provided with GFI receptacles and with dedicated phase, neutral, and equipment ground conductors.
- F. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left.
- G. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
  - 1. Coordinate device plate and wiring device finish color with Architect prior to purchase and installation.

### 3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

#### WIRING DEVICES

1. Receptacles: Identify panel and circuit number from which served. Use self-adhesive labels with black letters on a clear background. Lettering height shall be 3/16 inch, or height as required to allow adequate space for the required identification.

# 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

# 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

SECTION 262813 – FUSES (600V AND LESS)

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Cartridge fuses rated 600 V and less for use in switches and controllers.

### 1.3 REFERENCES

- A. UL 198E Class R Fuses.
- B. FS W-F-870 Fuseholders (For Plug and Enclosed Cartridge Fuses).
- C. NEMA FU 1 Low Voltage Cartridge Fuses.
- D. NFPA 70 National Electrical Code

#### 1.4 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.

### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

# 1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

# 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Quantity equal to 1 set of three for each type and size used on this project.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fuses:
    - a. Cooper Bussman, Inc.
    - b. Ferraz Shawmut, Inc.
    - c. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

# 2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, non-renewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 FUSE APPLICATIONS

A. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless noted otherwise.

- B. Control transformer fuses: Class CC (time delay).
- C. Motor Branch Circuits: Class RK5, time delay, unless noted otherwise.
- D. Fuses for packaged equipment: Size as recommended by equipment manufacturer.

# 3.3 INSTALLATION

A. Provide fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

# 3.4 IDENTIFICATION

A. Provide labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 262813

# SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - 3. Molded-case circuit breakers.
  - 4. Molded-case switches.
  - 5. Enclosures.

## 1.3 REFERENCES

A. NEMA KS 1 – Enclosed Switches.

#### 1.4 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current rating.
  - 4. Features, characteristics, ratings, and factory settings of individual over-current protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 26 Section "Hangers and Supports for Electrical Systems." Include the following:

- 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures" include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.
- F. Warranties.

# 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

# 1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

# 1.8 WARRANTIES

A. The manufacturer shall warrant the enclosed disconnect switches and circuit breakers and accessories against all defects in material and workmanship.

- 1. Warranty Period: 2 years.
- 2. Start of warranty period shall be at substantial completion.
- 3. See Division 01 Specifications for additional warranty requirements.

# PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
  - 1. Square D.
  - 2. General Electric.
  - 3. Eaton Corp; Cutler Hammer Products
  - 4. Siemens Energy & Automation, Inc.

## 2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  - 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

# 2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
  - 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and I<sup>2</sup>t response.

- 4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 5. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
- C. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Molded-Case Switch Accessories:
  - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
  - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

# 2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Indoor Locations: NEMA 250, Type 1.
  - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

# 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

# 3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
  - 3. Verify rating of installed fuses.
  - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.
- B. Perform operational tests to verify operation of equipment. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

# 3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges. Coordinate setting requirements with Owner and Engineer.

# 3.6 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 262913 – ENCLOSED CONTROLLERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes alternating current, enclosed controllers rated 600 V and less, of the following types:
  - 1. Manual controllers.
  - 2. Magnetic controllers.
  - 3. Combination magnetic motor controllers.
- B. This section also includes Power Factor Correction Capacitors for use with motor type loads.
- C. Related Sections include the following:
  - 1. Division 26 Section "Hangers and Supports for Electrical Systems" for seismic restraint requirements.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of motor starter (controller) and combination motor starter, relays, pilot devices, and switching and over-current protective device. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each type of motor starter, controller, and motor control center.
  - 1. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include:
    - a. Conduit entrance locations and requirements;
    - b. Wiring diagrams that differentiate between manufacturer-installed and filedinstalled wiring for power, signal, and control wiring.
    - c. Nameplate legends;
    - d. Size and number of bus bars per phase and ground;
    - e. Electrical characteristics including voltage, frame size, trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed controllers, accessories, and components will withstand seismic forces defined in Division 26 Section "Hangers & Supports for Electrical Systems." Include the following:

- 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Project Closeout," include the following:
  - 1. Routine maintenance requirements for controllers, motor control centers, and all installed components and accessories.
  - 2. Manufacturer's written instructions for testing and adjusting over-current and over-load protective devices.
  - 3. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- F. Load-Current and Overload-Device List: Compile after motors have been installed and arrange to demonstrate that adjustment of over-load device suits actual motor nameplate full-load currents.
- G. Warranties.

# 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

# 1.5 REFERENCES

- A. NEMA ICS 6 Enclosures for Industrial Controls and Systems.
- B. FS W-C-375 Circuit Breakers, Molded Case; Branch Circuit and Service.
- C. FS W-P-115 Power Distribution Panel.
- D. FS W-F-870 Fuseholders (For Plus and Enclosed Cartridge Fuses).

- E. FS W-S-865 Switch, Box, (Enclosed), Surface-Mounted.
- F. NEMA AB 1 Molded Case Circuit Breakers.
- G. NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies.
- H. NEMA KS 1 Enclosed Switches.
- I. NEMA PB 1 Panelboards
- J. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 Volts or less.
- K. ANSI/UL Standard 508.
- L. IEEE Standard 519-1981 Guide for Harmonic Control and Reactive Compensation of Static Power Converters.
- M. FCC Rules and Regulations, Part 15, subpart J-Radio Frequency Interference.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Deliver motor control centers in shipping splits of lengths that can be moved past obstructions in delivery path. The shipping splits shall be individually wrapped for protection, and mounted on shipping skids.
  - B. Store in a clean, dry space. Maintain factory wrapping o provide an additional heavy canvas or heavy plastic cover to protect units from fumes, dir, water, construction debris, traffic and physical damage.
  - C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components. Enclosure, and finish.

# 1.7 SPARE PARTS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contants.
- B. Keys: Furnish four of each.
- C. Fuses: Furnish one set of three for each type and rating installed.
- D. Fuse Pullers: Furnish one fuse puller.
- E. Indicating Lights. Furnish two of each type installed.

#### 1.8 WARRANTIES

A. Manufacturer shall warrant motor control centers, motor controllers, and all components and accessories against defects in material and workmanship.

- 1. Warranty Period: 2 years.
- 2. Start of warranty period shall be at substantial completion.
- 3. See Division 01 Specifications for additional warranty requirements.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Company; GE Industrial Systems.
  - 2. Square D.
  - 3. Eaton Corporation; Cutler Hammer Products
  - 4. Siemens Energy & Automation

### 2.2 MANUAL MOTOR STARTERS

- A. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated nonreversing full-voltage controller for induction motors rated in horsepower, with overload relay and toggle operator.
- B. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.
- C. Motor Starting Switch: NEMA ICS2; AC general–purpose Class A manually operated. Fullvoltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.
- D. Enclosure: NEMA ICS 6; Type 1.

#### 2.3 MAGNETIC MOTOR STARTERS

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Full Voltage Starting: Non-reversing type, unless otherwise indicated.
- C. Coil Operating Voltage: 120 volts, 60 Hertz, obtained from integral control power transformer.
- D. Size: NEMA ICS 2; size as shown on the drawings.
- E. Overload Relay:
  - 1. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
- F. Enclosure: NEMA ICS 6;
  - 1. Indoors, Dry Locations: Type 1.
  - 2. Outdoors, Wet Locations: Type 3R
- G. Combination Motor Starters: Combine motor starters with disconnect switch in common enclosure. Provide with disconnecting means as indicated on drawings.
- H. Auxiliary contacts: NEMA ICS 2; two normally open, field convertible contacts in addition to seal-in contact.
- I. Elapsed Time Meters: Heavy duty with readout in tenths of an hour.
- J. Indicating Lights: NEMA ICS2; RUN: red in front cover.
- K. Selector Switches: NEMA ICS2; HAND/OFF/Auto, in front cover.
- L. Relays NEMA ICS2.
- M. Control Power transformers: 120 volt fused secondary, fused primary, minimum VA of sufficient capacity to operate connected pilot, indicating, and control devices, plus 100% spare capacity or as indicated below (whichever is greater):
  - 1. Size 1 100 VA
  - 2. Size 2 100 VA
  - 3. Size 3 150 VA
  - 4. Size 4 300 VA
  - 5. Size 5 300 VA
  - 6. Size 6 300 VA
- N. Provide phase loss protection relay with contacts to de-energized the starter for each starter servicing motors 5HP or greater.

## 2.4 CONTROLLER OVER-CURRENT PROTECTION AND DISCONNECTING MEANS

- A. Controller Disconnecting Means: Factory-assembled combination disconnect and controller. (See Contract Drawings for type and configuration of disconnecting and over-current protection required):
  - 1. Fusible Switch Assemblies: NEMA KS 1, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Provide with Class "R" rejection clips. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a nationally recognized testing laboratory.
  - 2. Non-fusible Disconnecting Means: NEMA KS 1, heavy-duty, non-fusible switch.
  - 3. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with fieldadjustable, short-circuit trip coordinated with motor locked-rotor amperes.

PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's instruction.
- B. Install fuses in fusible switches.
- C. Adjust over-current adjustable circuit breaker settings per connected load requirements. Coordinate requirements with Engineer.
- D. Set adjustable over-load devices as required for protection of motor loads.
- E. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior lighting fixtures, lamps, and ballasts.
  - 2. Exterior lighting fixtures normally mounted on exterior of buildings.
  - 3. Emergency lighting units.
  - 4. Exit signs.
  - 5. Lighting fixture supports.
- B. Related Sections include the following:
  - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including multi-pole lighting relays and contactors.

## 1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing if provided.

## 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Energy-efficiency data.
  - 4. Life, output, and energy-efficiency data for lamps/LED.
  - 5. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
- B. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranties: Special warranties specified in this Section.

### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### 1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

### 1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Refer to Division 01 section for additional warranty requirements, including but not limited to start of warranty period.

## PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the manufacturers specified on the contract drawings.
  - 1. Product equal review requests will be accepted up to 10 calendar days prior to bid date.
  - 2. Only products which are shown on the contract drawings (or added by addendum) shall be provided.

### 2.2 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

## 2.3 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

### INTERIOR LIGHTING

- 1. Battery: Sealed, maintenance-free, NiCad type.
- 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
- 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- 5. LED indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright flow indicates charging at end of discharge cycle.
- 6. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
- 7. Integral Self-Test: Factory-installed electronic device automatically initiates coderequired test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

## 2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channeland angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- C. Rod Hangers: 3/16 inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid as a support element. Lighting fixtures shall be independently supported from building structural steel.
  - 1. Support fixtures with a minimum of four #12 AWG minimum support wires attached to each corner of the fixture.
- C. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low Voltage Electrical Power."

# 3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior luminaires with lamps and ballasts.
  - 2. Poles and accessories.
- B. Related Sections include the following:
  - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.
  - 2. Division 26 Section "Lighting Control Devices" for programmable light control systems.

#### 1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. Luminaire: Complete lighting fixture, including ballast housing if provided.
- C. Pole: Luminaire support structure, including tower used for large area illumination.
- D. Standard: Same definition as "Pole" above.

#### 1.4 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.
  - 3. Details of installation and construction.
  - 4. Ballasts, including energy-efficiency data.
  - 5. Materials, dimensions, and finishes of poles.
  - 6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
  - 7. Anchor bolts for poles.

- B. Shop Drawings:
  - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
- C. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this section.

### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - A. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
  - B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

#### 1.7 WARRANTY

- A. A special warranty for ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in material or workmanship within specified warranty period.
  - 1. Warranty Period: Three years.

#### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation on the contract documents.
  - 1. Product equal review requests will be accepted up to 10 days prior to bid date.
  - 2. Only products which are shown on the contract drawings (or added by addendum) shall be provided.

#### 2.2 LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

## 2.3 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
  - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 90 mph, with a gust factor of 1.3.
  - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  - 1. Materials: Shall not cause galvanic action at contact points.

- 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
- 3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

## PART 3 - EXECUTION

## 3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
  - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

## 3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
  - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
  - 3. Trees: 15 feet.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
  - 3. Install base covers, unless otherwise indicated.

- 4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Raise and set poles using web fabric slings (not chain or cable).

## 3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.4 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole, unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

## 3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

END OF SECTION 265600

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

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. Communications equipment coordination and installation.
  - 2. Sleeves for pathways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common communications installation requirements.

## 1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

A. Product Data: For sleeve seals.

#### 1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR PATHWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

## 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM and NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

- 3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION
  - A. Comply with NECA 1.

- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

## 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, fire-rated floor and wall assemblies, or any non-fire rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 12 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".
- J. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

# 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 270500

# SECTION 271310 - STRUCTURED VOICE AND DATA CABLING SYSTEMS

PART 1- GENERAL

#### 1.1 SUMMARY

- A. This specification includes all labor and material as required to provide telephone (voice) and data distribution system infrastructure.
- B. The extent of the voice & data system infrastructure shall include all materials and labor required to:
  - 1. Connect all voice & data outlets to patch panels in the communication room.
  - 2. Interconnect all communication rooms to the main communication room.
- C. The voice & data infrastructure shall include, but not be limited to:
  - 1. Wiring/cabling, signal transmission media (copper & fiber).
  - 2. Equipment racks.
  - 3. Device plates & jacks.
  - 4. Wire management systems.
    - a. Cable tray systems
    - b. Cable support slings.
    - c. J-hooks.
  - 5. Terminations and termination blocks.
  - 6. Patch panels.
  - 7. Ancillary equipment.
  - 8. Testing
  - 9. Labeling.
  - 10. Record documents.
  - 11. Conduits (which are not shown on contract drawings) but are required to provide a path for installation of voice and data system cables.
  - 12. Fire stopping of all sleeves, conduits, and cable trays which penetrate fire walls and floors
- D. The owner will furnish and install:
  - 1. Dedicated UPS systems
  - 2. Switching hubs
  - 3. Patch cords.
  - 4. Voice and data service cables and terminations to the building main telecommunication room.
- E. Abbreviations: The following abbreviations are used within this document.
  - 1. Mhz Megahertz
  - 2. dB Decibel
  - 3. NEXT Near End Crosstalk

- 4. ELFEXT Equal Level Far End Crosstalk
- 5. ACR Attenuation to Crosstalk Ratio
- 6. ATM Asynchronous Transfer Mode
- 7. BICSI Building Industry Consulting Services International
- 8. ANSI American National Standards Institute
- 9. TIA/EIA Telecommunications Industry Association/Electronic Industries Association.

# 1.2 SUBMITTALS

- A. Product Data:
  - 1. Submit manufacturer's technical data and cut sheets for all:
    - a. Equipment
    - b. Components
    - c. Wire management systems (J-hooks, Slings, cable trays, etc)
    - d. Patch panels (copper & fiber)
    - e. Device jacks
    - f. Connectors (copper & fiber)
    - g. Cable
    - h. Test equipment
    - i. Identification labels
    - j. Racks
    - k. Fiber
    - I. Fiber connector housings
    - m. Fiber fusion splicing housings (if applicable)
    - n. Termination blocks.
  - 2. Submit product data and UL method for fire stopping of sleeves and cable tray penetrations.
  - 3. Submit contractor developed proposed communication room layout plans indicating quantity of racks, patch panels, rack locations, wire management, telephone system cable termination locations and layout.
- B. Test Data: Submit test data for items as outlined in paragraph QUALITY ASSURANCE.
- C. Warranties: Submit a copy of warranties for all cabling and equipment. This information shall be included in the maintenance manual.
- D. Shop drawings:
  - 1. Submit layout drawings of telephone, and data systems and accessories.
  - 2. Shop drawings shall include, racks, equipment, and accessories, communication room detail design, and rack design.
  - 3. Shop drawings shall also include details of proposed U.L. listed fire stopping for penetrations of fire walls and floors.

- E. Maintenance Manual: Provide a quantity of Three (3) maintenance manuals which shall include all the items identified in paragraphs 1.2.A. through 1.2.D. The maintenance manuals shall also include product manuals for all equipment provided. Maintenance manuals shall also include "AS-BUILT" documentation, and phone numbers for repair, maintenance, and replacement parts.
  - 1. "AS-BUILT" documentation shall be assembled in loose leaf binders and shall include:
    - a. System Schematic Diagrams.
    - b. System wiring lists and AUTOCAD floor plans that indicate device location & identification. Provide full size (i.e. 1/8" = 1'-0" scale) hard copy drawings and AUTOCAD drawing files on CDROM.
    - c. Test data documenting performance in compliance with the requirements identified in this specification. Provide hard copy of test data (individual 8.5" x 11" sheet per cable/fiber) and soft copy on CDROM.
    - d. Documentation shall be neatly organized by each building and by each communication room.
- F. Installers Qualifications & BICSI certification.

## 1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of computer systems and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Installer(s) shall be electricians and shall have at least 5 years of successful installation experience with projects utilizing telephone and data systems, and equipment similar to that as specified for this project. The on-site project manager (i.e. On-site supervisor for the installation of the cabling) shall be BICSI certified for Category 6 installation.
- C. Codes and Standards: All installation shall be in accordance with the National Electrical Code and the following ANSI/EIA/TIA codes.
  - 1. TIA/EIA 568-B.2-A. Commercial Building Telecommunications Cabling Standards.
  - 2. TIA/EIA 569-A. Telecommunications Pathways and Spaces.
  - 3. TIA/EIA 607. Bonding and Grounding.
  - 4. TIA/EIA TSB-36. Additional UTP Specification
  - 5. TIA/EIA TSB-40A. Additional Connecting Hardware Specifications
- D. IEEE Compliance: Installations shall comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to communication systems.
- E. Testing: Telephone and data system cable installation shall be tested as described below. Results of these tests shall be documented and submitted to the engineer and Owner for review. The test data shall also be included in the maintenance manuals described in section SUBMITTALS.
  - 1. Telephone (Voice) Cable: All high pair count telephone system cables, telephone system cables to emergency phone locations, and horizontal telephone system cables shall be tested for: continuity, shorts, opens, and split pairs. Cable runs that do not pass these tests shall be repaired or replaced.
  - 2. Fiber Optic Testing: All strands of fiber optic cables shall be tested using power meter and light source for total attenuation and length and an Optical Time Domain

Reflectometer (OTDR) trace of cable showing all events in fiber. Each fiber shall be bidirectionally tested at 850 and 1300 nm (for multi-mode) and 1310 and 1550 nm (for single-mode). Cable runs that do not meet these performance levels shall be replaced.

- a. Intra-Building & Building-to-Building Cable:
  - (1) Multi-mode Fiber: Maximum attenuation 3.0 dB/km at 850 nm, and 1.0dB/km at 1300 nm plus 0.5 dB loss for each connector pair mating.
  - (2) Single-mode Fiber: Maximum attenuation 0.7 bD/km at 1310 nm, and 0.7 bD/km at 1550 nm plus 0.5 dB loss for each connector pair mating.
- 3. Horizontal Data Cabling: All horizontal data cable channels (i.e. device jack to patch panel) shall be bi-directionally tested for TIA/EIA CAT 6 performance requirements. Cable runs which do not pass these tests shall be repaired or replaced.
- 4. A hard copy print out of test results shall be provided as part of the O&M manuals. The test results for each channel shall be on a separate sheet. The test data sheets shall be arranged in numerical order for easy reference.
- 5. Test Equipment: Test equipment shall have a minimum of 10 dB better margin than the required performance limits to ensure accuracy of test results. Test equipment which does not meet this requirement is not acceptable. All horizontal cabling test equipment shall be a minimum of a level IIIe as recommended by the ANSI/TIA568b.2 Ad 10 document.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and cabling shall be delivered to the site in factory fabricated containers or wrappings, which shall properly protect equipment and cabling from damage.
- B. Store equipment and cabling in original packaging. Store indoors in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.
- C. Handle equipment and cabling carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged equipment or cabling. Damaged equipment and cabling shall be replaced with new.

## 1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation with the work of all other trades involved with the construction project. This coordination shall include participation in weekly construction progress meetings before and during actual installation of equipment and cabling. Contractor shall coordinate cable installation routes with all other trades. No extra compensation will be allowed for removal/reinstallation of cable, supports or other equipment which is in the way of other trades. It shall be the contractor's responsibility to keep informed of the work and space requirements of all other trades. It shall also be the contractor's responsibility to inform all other trades of the proposed cable routes, hanger, locations, and other equipment installation.

# 1.6 MAINTENANCE & WARRANTIES

- A. Warranties:
  - 1. The contractor shall provide a 2-year warranty of materials and workmanship, providing for labor and materials to correct any defects found before and after substantial completion of the project. The warranty period shall begin at the time of completion or at the time the Owner first receives beneficial use, whichever comes first. Start of warranty

shall be issued in writing to the owner and owner's representative.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with the requirements, provide complete fiber optic nd copper channel solutions (i.e. products to connect the work area outlets to patch panels) with products by one of the manufacturer combinations identified below. All products provided shall be a complete solution (i.e. Mixing and matching of components will not be acceptable). No substitutions will be acceptable without written approval prior to opening of bids.
  - 1. Voice & Data systems & Fiber Optic Systems:
    - a. Mohawk AdvanceNET/ Hubbell NEXTSPEED CAT 6 solution and appropriate matching Mohawk/Hubbell fiber optic solution.
    - b. Belden Cat 6 Cable/ Belden REV connect Cat 6 connectivity and appropriate matching Belden fiber optic solution.
    - c. Commscope (uniprise Cat 6 cable / uniprise Cat 6 connectivity) and appropriate matching Commscope fiber optic solution.
    - d. nCompass solution (Superior Essex Series 77 Cat 6 cable/Ortonics TechChoise Cat 6 connectivity) and appropriate matching nCompass fiber optic solution.

## 2.2 TELEPHONE (VOICE) SYSTEM REQUIREMENTS

- A. Horizontal Telephone Cable requirements. (See Horizontal Data Cable Requirements).
- B. Intra-Building (Riser MDF-to-IDF) Telephone Cable requirements.
  - 1. Intra-Building telephone system riser cables shall meet or exceed the following minimum requirements:
    - a. CAT 3 UTP requirements in ISO/IEC 11801, CENELEC EN50173, and TIA/EIA-568B.2.
    - b. Conductors: 24 AWG solid copper insulated with color-coded PVC.
    - c. Non-Plenum rated cable.
    - d. Pair Count: As noted on drawings or within other paragraphs of this specification.
    - e. Systimax 1010 Multipair Cable. (ANIXTER PART #CM-10024MAX-3).
- C. Wiring Block Systems (For high pair count Intra-Building Riser cables).
  - 1. Telephone system wiring blocks shall meet or exceed the following minimum requirements:
    - a. Shall support Gigaspeed and Power SUM Channels.
    - b. Shall accommodate 900 pairs.
    - c. Shall be provided with clear label holders.
    - d. Provide wiring blocks with a minimum quantity of 25 percent spare termination points.
    - e. Wiring blocks and components shall be specifically designed for use with the cable

specified.

- f. Provide wiring blocks complete with strip / cover plates for protection of terminated cables.
- g. Five (5) pair wafer (connecting) blocks shall be provided for termination of Intra-Building (Riser) cables.
- h. The "U" shaped back panel shall be installed within the 7 for vertical wire management.
- i. Separate (and dedicated) 110 Patch Panel System Terminal Blocks shall be provided for termination of Intra-Building high-pair count voice cables.
  - (1) Provide Siemon Product Number:
    - (a) S110AW2-300 (ANIXTER PART #156690) 300 pair Block 110 with legs CAT5E Non-Terminated, with 5 pair wafer.
  - (2) 110 Patch Panel Assembly for high-pair count feeder cables shall be housed within a dedicated Cable Management Panel.
    - (a) If more than 300 pair is required, then multiple 300 pair 110 blocks shall be stacked within the same dedicated cable management panel.

## 2.3 DATA SYSTEM REQUIREMENTS

- A. Intra-Building Data Cable (Riser) requirements.
  - 1. Data system Intra-building fiber cable shall meet or exceed the following minimum requirements:
    - a. Multi-mode:
      - (1) Core Diameter: 50 um.
      - (2) Cladding Diameter: 125 um.
      - (3) OM4 Grade LOMMF
      - (4) Number of strands as noted on the drawings or specified elsewhere in this specification.
    - b. Single-mode:
      - (1) Number of strands as noted on the drawings or specified elsewhere in this specification.
- B. Building-to-Building (Installed within outdoor locations) Data Cable requirements.
  - 1. Data system Intra-building fiber cable shall meet or exceed the following minimum requirements:
    - a. Multi-mode:
      - (1) Core Diameter: 50 um.
      - (2) Cladding Diameter: 125 um.
      - (3) OM4 Grade LOMMF
      - (4) Number of strands as noted on the drawings or specified elsewhere in this specification.
    - b. Single-mode:
      - (1) Number of strands as noted on the drawings or specified elsewhere in this specification.
- C. Fiber Connectors.
  - 1. Fiber termination connectors shall be specifically designed for use with the cable

specified and shall meet or exceed the following requirements (*Note: Verify with the Owner's I.S. department prior to submittal process*).

- a. Multi-Mode Fiber:
  - (1) Average Insertion Loss: 0.1dB standard Deviation 0.1dB
  - (2) <u>Small Form Factor type LC</u>
- b. Single-Mode Fiber:
  - (1) Average Insertion Loss: 0.1dB standard Deviation 0.1dB
  - (2) Small Form Factor type LC
- D. Fiber Termination Housings.
  - 1. Fiber termination housings shall be specifically designed for use with the cable and connectors specified and shall meet or exceed the following requirements.
    - a. IDF communication rooms or main communication rooms requiring termination of 24 or less strands of fiber
      - (1) Capable of terminating 48 fiber cables with LC type connectors
      - (2) Front access with sliding shelf
      - (3) Standard 19 rack mountable
      - (4) 1 rack unit height
      - (5) Metallic cover
      - (6) 1 unit trough wire management attached to the front of the shelf
    - b. Main communication rooms and communication rooms requiring termination of more than 24 strands of fiber.
      - (1) Capable of terminating 144 LC connectors
      - (2) Built-in cable slack management.
      - (3) 4 rack units in height
      - (4) Front and rear accessibility
      - (5) Standard 19 rack mountable
      - (6) Front and rear covers
- E. Horizontal Data Cable requirements.
  - 1. All data system horizontal cable shall meet the following minimum requirements:
    - a. Plenum rated cable shall be provided where appropriate.
    - b. Performance specifications of TIA/EIA CAT 6 UTP
    - c. Color blue outer insulation for data cables.
- F. Data System Patch Panels:
  - 1. All data system Patch Panels shall meet the following minimum requirements:
    - a. TIA/EIA CAT 6
    - b. T568B standard for pair termination.
    - c. Patch panels shall be provided with a minimum quantity of 25 percent spare ports, which are fully equipped and ready for terminating future cable terminations.
- G. Data System Device Jacks.

- 1. All data system device jacks shall meet the following minimum requirements:
  - a. Colors:
    - (1) Gray Data Jacks.
  - b. RJ-45 Modular jack.
  - c. Device jacks shall be flush with device plates. The device jacks shall not protrude past the front of the device plate.
  - d. T568B standard for pair termination
  - e. Pin/Pair termination as follows:
    - PIN PAIR
    - 1 white/orange
    - 2 orange
    - 3 white/green
    - 4 blue
    - 5 white/blue
    - 6 green
    - 7 white/brown
    - 8 brown

## 2.4 DEVICE PLATE REQUIREMENTS

- A. Device plates for data, telephone, and combination data/telephone outlet locations shall be plastic. The finish color match the color of receptacle and lighting switch type wiring devices and shall be determined during shop drawing review.
- B. Contractor shall provide blank device plates for all data, telephone, and combination data/telephone outlet locations left empty by this contract.
- C. Provide device plates which support the quantity of data and telephone jacks as required at each outlet location, unless noted or specified otherwise in this specification or on the contract drawings.
- D. Provide device plates capable of supporting wall phones at all locations where telephone outlets are installed at wall-phone heights (i.e. +54" A.F.F.).
- E. All device plates, except for wall phone locations, shall be Duplex type. Unused ports shall be provided with blank covers, color to match device plate.

## 2.5 CABLE SUPPORTS

- A. Large Bundle Supports. Caddy Cat. No. 425, UPC No. 33179, or approved equal or better.
- B. J-hook Supports. Category 5.
- 2.6 EQUIPMENT CABINETS (Telephone and data systems, copper & fiber cables)
  - A. All equipment racks shall meet the following minimum requirements:
    - 1. Approximately 20.3 inches (width) with standard 19-inch center mounting
    - 2. 84 inches (height) minimum
    - 3. 6 inches minimum channel depth
    - 4. Base footprint: approximately 20.3" (width) x 15" (depth)

- 5. Pre-drilled and equipped with screws to match the holes. Hole pattern EIA-310-D 5/8" 5/8"  $\frac{1}{2}$ " alternating.
- 6. Quantity of 45 rack mounting units (RMUs)
- 7. Designed to be mounted to the floor and equipped with seismic supports.
- 8. Top of rack shall be provided with two top angles to provide strength and rigidity.
- 9. Rack shall provide the necessary strain relief, bend radius, and cable routing for proper installation of system cables and equipment.
- 10. Rack shall be provided with a grounding kit for grounding of rack to meet EIA/TIA 607 standards.
- 11. Finish: Durable black powder coat.
- 12. Material: 6063-T6 extruded aluminum.
- 13. All equipment racks shall be provided with 6" wide vertical wire management on each end of the rack (dedicated to the associated equipment rack). Front and rear covers shall be provided on the vertical wire management.
  - a. Channel Material: 14 ga cold-rolled steel.
  - b. Cover Material: 16 ga cold rolled steel.
  - c. Finish: Durable black powder coat.
- 14. Horizontal wire management shall be provided above and below each patch panel. Horizontal wire management shall include both front and rear cable management and covers.
  - a. Material: 16 ga cold rolled steel.
  - b. Rings: Qnty of 7 rings (on both front and back sides) consisting of 0.225" diameter steel rods.
  - c. Finish: Durable black powder coat.
  - d. Pass-thru holes: Qnty of 6.
  - e. Hinged Covers: Front and back sides.

# 2.7 CABLE TRAYS

- A. Ladder Type. All ladder type cable tray systems shall meet the following minimum requirements:
  - 1. Width: 18"
  - 2. Material: 16 ga tubular steel.
  - 3. Finish: Durable black powder coat.
  - 4. Stringer dimensions: 0.375"(W) x 1.5"(H).
  - 5. Rung Spacing: 9"
  - 6. 45 lbs/ft weight capacity
  - 7. Provide with all accessories as required to support, splice, ground, and install per manufacturer's recommendations.
  - 8. Provide with accessories as required to support cables where cables enter and leave the cable tray system
  - 9. Manufactured by:
    - a. Chatsworth Products, Inc. # 11252-718 (ANIXTER # 263017).
    - b. Hubbell NEXT FRAME

# PART 3 – EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions under which the telephone and data systems are to be installed. Notify the owner and owner's representative in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected.

### 3.2 INSTALLATION OF DATA AND TELEPHONE SYSTEM CABLES

- A. Install systems as described and indicated, in accordance with manufacturer's written instructions and with recognized industry practices. Ensure systems comply with installation and operational requirements of Ethernet 100baseT, proposed Ethernet 100baseT, EIA, NEC, and the Federal Communications Commission.
- B. The following are requirements for the installation of copper data and telephone system cables.
  - 1. Replace any damaged cable
  - 2. Avoid unnecessary bending of the cable
  - 3. Minimum bending radius shall not be less than 10 times the diameter of the cable.
  - 4. Cables shall be installed such that all sources of EMI are avoided. All cables shall be kept away from lighting fixtures and other sources of EMI by a minimum of twenty-four (24) inches.
  - 5. Maintain the twists in the cable pairs as close as possible up to the mechanical termination point. At no time shall the length of untwisting exceed 0.25 inches. The insulation should be maintained as close as possible to the termination point.
  - 6. Cables shall not be dragged on floors or other abrasive surfaces during installation.
  - 7. Do not exceed a 90 degree bend on the cable
  - 8. Cables shall not be supported from mechanical or electrical systems or the support structures for mechanical or electrical systems. Cables shall be supported from dedicated supports for data and telephone system cabling. Cable supports shall be UL listed for support of category 5 cables. Large bundle supports shall be utilized whenever 16 or more cables are required to be supported.
  - 9. Data and video cables shall be separated by a minimum of 6 inches.
  - 10. Use only velcro wraps to bundle cables together.
  - 11. If tie-wraps must be used, do not over-tighten. Provide at least one index-finger of space in tie-wrap.
  - 12. Do not use staple guns.
  - 13. Do not install data cables in the same conduit as video cables. (The only exception to this requirement shall be at location of combination data/telephone outlets).
  - 14. Do not exceed 90 meters on any data cable run.
  - 15. All cable shall be supported at a maximum spacing of 5' intervals. Cable support spacings shall be staggered and random (i.e. all support spacings shall not be 48").
  - 16. Cables shall be installed continuous from termination point to termination point. Cables

shall not be spliced.

- 17. Test all cables for performance as required by this specification.
- 18. Provide a minimum of twenty (20) feet of service coil in the nearest accessible ceiling cavity near each voice, data, and combination voice/data work area outlet. This coil shall be neatly attached to the conduit serving the work area outlet.
- 19. Coordinate all equipment layouts and installation within communications rooms with the engineer and Owner's IT Department prior to purchase of equipment. All equipment layouts and other installation within communication rooms shall be approved by the Owner's IT Department.
- 20. Terminate and test all pairs of cables installed.
- 21. Horizontal cables shall be terminated on patch panels within each communication room and on RJ-45 jacks at the Work Area Outlets. All pairs shall be terminated and tested.
- 22. Do not expose the cables to a pulling tension greater than 25 lbf during installation, to avoid stretching the conductor during installation.
- 23. Special care shall be used during installation of cables to avoid twisting of the cable.
- 24. Provide conduit sleeves through walls where cables penetrate walls. Bush both ends of conduit sleeves.

## 3.3 INSTALLATION OF RACKS WITHIN TELECOMMUNICATION CLOSETS

- A. Rack shall be furnished by Owner.
- B. Seismically secure racks as follows:
  - 1. To the structural floor at bottom.
  - 2. Secure top of racks to the building structure to prevent top of racks from moving.
- C. Provide vertical wire managers on rack ends and between all racks.
- D. Provide horizontal wire managers on racks above and below each patch panel provided.
- E. Provide patch panels within racks with sufficient capacity to terminate all copper and fiber cables installed on the floor(s) under this contract plus an additional 25 percent capacity for spare.
- F. Bond (using #10 AWG copper conductor) each equipment rack to the ground bus in the communications room or to the equipment ground bus bar in the branch circuit panel which feeds the receptacles within the communications room.
- G. Coordinate all installation within communication rooms with the engineer prior to purchase of equipment.

## 3.4 TERMINATION OF DATA AND TELEPHONE SYSTEM HORIZONTAL CABLES

- A. Terminate cables at device outlet location on 8-position, 8 conductor RJ45 jacks.
- B. Terminate cables on patch panels within telecommunication closets. Patch panels for voice & data cables shall be one in the same.
- C. Provide a quantity of data cables to each outlet location, as noted on the Contract drawings
- D. Provide four service (quadruplex type) device plates at all combination telephone/data outlet locations.

E. Provide device plates with accessories as required and capable of physically supporting wall phones at all locations where telephone outlets are installed at wall-phone heights (i.e. +54" A.F.F.).

### 3.5 LABELING

- A. Voice/Data System Horizontal Cables.
  - 1. All horizontal voice & data system cables shall be identified at both ends on the cables, on the patch panels, and on the finished side of the device plates. The labeling scheme for the voice & data system horizontal cabling shall be as follows:
    - a. Communications room number, followed by the associated
    - b. Equipment rack number & patch panel letter, followed by the associated
    - c. Outlet & device jack alpha-numeric number & letter (i.e. 1A, 2A, etc).
  - 2. Patch panels provided for termination of voice & data system horizontal cables shall be labeled "1A", "1B", "1C", 2A, 2B, 2C etc. where the number indicates the equipment rack and the letter indicates the patch panel.
  - 3. Each jack on the patch panels shall be labeled as follows:
    - a. Room number where outlet is located, followed by the associated
    - b. Outlet box number & device jack letter (i.e. 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D, 3A, 3B, 3C, 3D, etc).
  - 4. Device plates (each device jack) shall be labeled as follows:
    - a. Patch panel number & letter, followed by the associated
    - b. Outlet box number & device jack letter (.i.e. 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D, 3A, 3B, 3C, 3D, etc).
- B. Labeling on device plates shall consist of typed black lettering, on white background labels, installed behind clear plastic protectors. Size of lettering shall be maximum allowable with respect to available space.
- C. Labeling on cable ends and on the patch panel and termination blocks shall be neat and legible.

### 3.6 FIRE-STOPPING

A. Provide UL listed fire stopping in all sleeves & conduits installed through floors and fire walls. Contractor shall fire stop all sleeves & conduits, this includes spare sleeves & conduits left empty for future use.

## 3.7 RECORD DRAWINGS

A. Provide 1/8" = 1'-0" scale record drawing within the communication room. The drawing shall indicate voice/data outlet locations and identification labels. The drawings shall be created using AUTOCAD. The drawings shall be provided within metal frames and displayed behind clear Plexiglas. The drawings shall be hung within the communication room in a location as directed by the owner. A hard copy (and a copy of the AutoCAD drawing files on CDROM) of the drawings shall also be provided within the Operation and Maintenance Manuals specified above.

END OF SECTION 271310

SECTION 275123 - COMMUNICATION SYSTEM SCHOOL AND COMMERCIAL CONSTRUCTION

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, conduit (with pull strings), wiring, telephones, annunciators, speakers, and microphones as shown on the plans, and all other equipment necessary to provide a complete and operating system for the McCutchanville Elementary School.
- B. Equipment supplied by Valcom, Atlas Sound, Lowell, Quam-Nichols, Shure, Crown, ADL, and WPW shall be considered as meeting these specifications and as the base bid. The specifying authority must approve any alternate system. Bidders supplying an alternate system must make the authority aware of their intentions and provide adequate information, including catalog cuts, working and shop drawings and a demonstration of the proposed system at least 10 days prior to bid date. Any prior approval of an alternate system does not exempt the supplier from meeting the intent of these specifications. If the alternate system fails to provide all the requirements specified in this document, the Contractor shall be responsible for all costs associated with the removal and replacement of said equipment.
- C. The Communication system shall provide distribution of intercom, overhead paging, emergency paging, class change time tones, emergency tone and program material.
- D. System shall be provided by a single source: SolTek: Mr. Steve Boyer, 812-963-9180.

### 1.2 SUBMITTALS

- A. Data sheets shall be provided on all equipment being provided.
- B. Internal control cabinet drawings showing internal block diagram connections shall be provided.
- C. Wiring diagrams showing typical field wiring connections shall be provided.
- D. FCC registration number shall be provided.

#### 1.3 QUALIFICATIONS

- A. The Contractor shall be from an established and locally run business which has been operating in the area for a minimum of five years.
- B. The Contractor shall show evidence that he maintains a service organization and parts inventory to adequately support the supplied equipment.

#### 1.4 MAINTENANCE SERVICE

A. The Contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or engineer.

B. A maintenance contract offering continued factory authorized service of this system shall be made available if requested by the Owner.

# QUALITY ASSURANCE

- 1.10 The Contractor shall currently maintain a locally run business for a minimum of five years and shall be an authorized distributor of the supplied equipment with full warranty privileges.
- 1.11 The supplying Contractor shall have attended the manufacturer's installation and service school.
- 1.12 The Contractor shall furnish manufacturer's manuals of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper operation of the system must be included. Any bidder using other than the specified equipment must provide this information prior to bidding.
- 1.13 As built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

## IN SERVICE TRAINING

- 1.15 The Contractor shall furnish a minimum of four hours of in service training with the system. These sessions shall be broken into segments that will facilitate the training of individuals in operating station equipment, administrative devices, user programming functions, and program distribution equipment. Operating manuals and users guides shall be provided at the time of the training.
- 1.16 The contractor shall provide subsequent trainings as requested by the owner for the first year free of charge.

## WIRING

1.16 System wiring shall be in accordance with good engineering practices as established by the EIA and NEC. Wiring shall meet all established state and local electrical codes. All wiring shall test free from grounds and shorts.

## PART 2 PRODUCTS

- 2.0 The installation shall include a comprehensive programmable microprocessor based communications system consisting of a central switching exchange capable of handling up to 360 remote stations.
- 2.1 All programmable functions shall be stored in non-volatile memory to prevent loss during a power failure condition.
- 2.2 System shall have provisions for battery back up and charger specifically designed for use with system power supplies. Systems that use an uninterruptible AC power supply (UPS) must be pre-approved.
- 2.3 The central switch shall utilize standard dual tone multi-frequency type decoding (DTMF) for conformance with standard telephone practices.

- 2.4 The central switch shall provide a LAN/WAN connection via a standard Ethernet RJ-45 jack to provide on or off site programming and or diagnostics. It shall be possible for the user with a computer connected to the LAN/WAN to access and change all system parameters as necessary and to save complete system architecture on its storage medium. It shall also be possible to run diagnostic software to isolate and correct faults in the system. These capabilities must also be provided thru a standard RS232 port for local access.
- 2.5 The system shall be provided with four (4) multifunction ports for connection of administrative phones, any loop start trunk (LST) port of a KEY or PBX telephone system. All communication between administrative phones shall be non-blocking. Provide a minimum of one LST port interface as part of this basic specification.
- 2.6 The system shall have the ability to be connected to a 10/100 switched, multicast enabled network. This connection shall be via a standard Ethernet RJ-45 jack and shall provide all system functionality across the LAN/WAN to remote cabinets eliminating the need for individual peripherals to be wired back to the main switch. All devices connected to these remote shelves shall provide the same capabilities as those connected directly to the MDF.
- 2.7 Provide a one (1) watt amplifier circuit for each remote station to allow absolute flexibility for simultaneous paging, program distribution and time tone schedules. Equipment requiring a single power amp for these functions shall size such an amp as to deliver a minimum of (1.5) watt per station to compensate for inherent transformer losses. Additional power will be required for hallway speakers, outside horns and common areas.
- 2.8 Facilities for a directly connected RS232 printer output to create a log of system activity. System activity logging and reporting shall also be delivered through the RJ-45 jack to be distributed across a LAN.
- 2.9 Capabilities of zoning incoming calls from any staff station location to any of four (4) multifunction ports.
- 2.10 Four (4) telephonic links between DTMF telephone locations.
- 2.11 Eight (8) unrestricted audio paths for private communication between administrative phones, administrative phones and staff stations, program distribution or time tone distribution and paging. The system must be able to perform multiple pages to different zones, class change tones and music distribution simultaneously. A minimum of four (4) simultaneous live voice pages while leaving four (4) additional paths for music and/or class change tones can be supported. Systems that cannot support a minimum of three (3) live pages and one (1) program distribution channel simultaneously will not be accepted.
- 2.12 Provide one (1) direct dialing, two-way voice amplified intercom link with automatic gain control for every twenty-four stations allowing multiple open voice conversations simultaneously.
- 2.13 Provide eight (8) separate time-tone schedules with a minimum of 1024 events. Individual events of each schedule shall be capable of sounding one of nine user defined tone types or custom messages from a customer programmed voice chip. These schedules can be run individually or simultaneously.
- 2.14 Eight (8) internal relays which can be controlled manually from any administrative phone or controlled automatically via an optional integral Master Time Control Center.

- 2.15 Provide (8) eight door release outputs for remote door lock control.
- 2.16 Program distribution of three (3) audio program sources simultaneously to any one or group of staff stations. Provide a Program Distribution Panel with the audio program sources listed below:
  - 2.16.1 Rack Mount 6 Disc CD Player
  - 2.16.2 1/8" Input for a Digital Audio Player
  - 2.16.4 Emergency Paging Mic
- 2.17 Ninety-six (96) paging zones and a dial on the fly group with two (2) priority levels of all call capability. Paging into any one zone shall not interrupt any program(s) previously distributed. If the areas receiving program are part of the page zone the program shall be interrupted during the page and returned automatically when the page is completed. Each group shall be able to have a custom name assigned to it simplifying programming of multiple groups of speakers.
- 2.18 Nine (9) built in software definable signaling tones. A voice chip with the option for a male or female voice, which can be used to store custom messages, labels for rooms and custom emergency tones. Voice announcements can be automatically or manually at any time.
- 2.19 Two (2), three (3) or four (4) digit programmable architectural room numbers for administrative and staff station locations.
- 2.20 Integral internal program clock for time tone distribution and other time related functions. It shall be possible to synchronize the program clock from an external master clock. The program clock can be used to control standard Sync wired clocks and Digital clocks with the addition of an optional Master Clock Board.
- 2.21 The system shall be provided with voice-synthesized call-in, which provides any administrative telephone audible annunciation of the calling parties location and architectural room number.
- 2.22 Enhanced Caller I.D. information for use with all administrative phones. It shall be possible to deliver industry standard enhanced Caller I.D. information to any third party phone system providing seamless annunciation of room numbers and operation between systems.
- 2.23 Discriminating ringing to distinguish different levels of incoming calls.
- 2.24 Selective pre announce tones: a) Single chime-Page b) Dual chime-Intercom call c) or a custom tone.
- 2.25 Call confirmation tone at the intercom speaker location when a call is placed. This tone verifies that the call has been placed into the system queue. A second confirmation tone shall be activated if the call is upgraded to an emergency call (See 2.31.3). Equipment, which does not notify the caller that the system has accepted the upgraded call, will not be accepted.
- 2.26 Unanswered emergency calls shall, after a user-determined time, have their architectural room number automatically announced over any one or group of speakers. This automatic page notifies nearby staff of an unanswered emergency condition and ensures staff notification of the emergency situation.
- 2.27 The Networked Trunk Port allows most loop start terminal devices to be connected to a managed IP based LAN/WAN. SIP connectivity allows the unit to

act as a gateway device between a SIP telephone system and Valcom paging systems, such as the Multipath. The NTP shall also provide connection to an InformaCast system for calls outside of the building. The NTP shall provide (2) station ports for connection to the intercom.

2.28 The administrative telephone shall be a standard DTMF set. Any system requiring a "smart" or proprietary type instrument will not be acceptable. The administrative phone may be equipped with an optional 4 x 20 LCD display for visual display of incoming calls. The following features will be provided by the administrative telephone:

## 2.28.1 Three levels of system access:

- a. Level 1 Dialing of any administrative or speaker station, all call, emergency all call, zone paging, scroll/erase call waiting queue, transfer and conference.
  - b. Level 2 Same as Level 1 with select and distribute program capabilities, set/reset alarm and relay functions.
  - c. Level 3 Same as Level 2 plus the capability to bump or join a conversation in progress and to access system setup menu for all programming features.
- 2.28.2 Speaker and microphone for hands free communication. Administrative Phones requiring a push to talk switch will not be accepted.
- 2.28.3 Multiple touch programmable function buttons for frequently dialed
  - functions, page groups, bell schedules, program distribution, etc.
- 2.28.4 Emergency programmable buttons for alert and evacuation tones.
- 2.28.5 Mute function for privacy.
- 2.28.6 Selective monitoring of program sources being distributed to staff locations.
- 2.28.7 Facilities to transfer or hold calls.
- 2.28.8 Auto redial of the previous two numbers dialed.
- 2.28.9 Adjustable ringer volume.
- 2.28.10 Hands free speaker volume control.
- 2.29 The V-DSP, Large Display Package shall include a large electronic sign and a sign driver card, Model V-ROM-D. When used with a Class Connection intercom system the V-DSP shall provide visual indication of incoming and connected intercom calls.
- 2.30 A Windows<sup>®</sup> based administrative software package to allow computer based access to all paging functions, including instantaneous distribution of pre recorded emergency messages shall be provided. The package shall utilize a point and click operation to allow music distribution to individual zones, manage any system controlled remote devices, manipulate schedules and paging groups as well as control time and clock functions. The software package shall be client-based to ensure that any programming changes are duplicated (backed up) in

the computer for download. Equipment not providing a computer-based operational user interface to the paging system or using browser-based programming will not be acceptable.

- 2.31 The staff station call-in assembly shall be a momentary contact spring return type switch and an integral volume control mounted to a stainless steel single gang plate. This volume control shall compensate for varying room sizes and acoustical conditions. The call-in switch shall be capable of 7 different access levels:
  - 2.31.1 Level 0 Normal Normal calls are initiated when activated.
  - 2.31.1 Level 1 Security Allows activation of a common system relay.
  - 2.31.1 Level 2 Normal/Emergency calls Normal calls are initiated by simply depressing the call-in switch. These stations can initiate an emergency call by depressing the call-in switch 4 times within 5 seconds. Emergency calls will display "HELP" on administrative displays and provide a special ring signal. This emergency call can be programmed to ring a special emergency phone.
  - 2.31.1 Level 3 –Urgent/Emergency Same as Level 2 except depressing the call switch once will initiate an "URGENT" call, which would be a higher priority than a "NORMAL" call.
  - 2.31.1 Level 4 –Night Allows for the ringing of the proper Administrative Telephone as well as all speakers in the building.
  - 2.31.1 Level 5 Emergency Depressing the call switch will immediately place an emergency call.
  - 2.31.1 Level 6 –Ignore Allows the call switch to be bypassed while not affecting the staff station speaker.
- 2.32 The staff station speaker shall be an 8" dual cone design with a minimum frequency response of 30Hz-18kHz. It shall have a minimum voice coil diameter of 3/4" and be capable of handling 10 watts of program power. Each speaker shall be provided with an individual volume control. Any system requiring a line matching transformer for each staff station location shall use a transformer of such quality that a minimum frequency response of 60Hz-12kHz will be provided.
  - 2.32.1 Classroom speakers shall be provided as indicated on drawings:

8" Ceiling mounted with white round metal baffle designed to mount in separate back box. Back box shall be designed to mount in industry standard drop ceiling. Provide back boxes and tile bridges for all speakers.

2.32.2 Self contained call-in intercom stations shall be vandal resistant with a stainless steel faceplate and mount in a 2 gang back box.

This unit shall include a 45-ohm speaker and an integral call switch.

- 2.33 The hallway and other multi speaker areas shall use speakers with an 8" dual cone design with a minimum frequency response of 30Hz-18kHz. It shall have a minimum voice coil diameter of <sup>3</sup>/<sub>4</sub>" and be capable of handling 10 watts of program power. Multi purpose area speakers shall incorporate 25/70 volt speaker assemblies with line matching transformers.
  - 2.33.1 Multi purpose area speakers shall be:

Ceiling mounted with white round metal baffle designed to mount in separate back box. Back box shall be designed to mount in industry standard drop ceiling. Provide back boxes and tile bridges for all speakers.

- 2.34 Weatherproof outside paging loudspeakers shall have a minimum power rating of fifteen (15) watts.
  - 2.34.1 The speaker shall have a minimum frequency response of 275-14kHz and a dispersion angle of 120 x 60 degrees. It shall be surface mounted, capable of delivering five fifteen (15) watts and be rated for outside use.
  - 2.34.2 The speaker shall have a minimum frequency response of 275-14kHz. It shall be flush mounted in a stainless steel vandal resistant enclosure. It shall be capable of delivering three (3) watts and be rated for outside use.
- 2.35 Provisions for the automatic distribution of paging announcements from a remote desk mounted microphone. Keying the microphone shall automatically mute all other audio sources and transmit the microphone signal to all rooms or specific groups of rooms as programmed into the system software.
- 2.36 Provide Program Monitor Assembly to preview audio material prior to distribution. Provide an antenna outside the rack to ensure proper reception on the FM band. Provide appropriate wall or desk rack mounting of this device as shown on drawings.
- 2.37 Provide impedance matching transformer for one way amplified Zones. There shall be one each of the zones ie; hallways, outside horns, gym, and cafeteria.
- 2.38 Provide a mixer amplifier for the multipurpose area speakers. The amplifier shall have a minimum of 3 inputs. This amplifier will be connected to the intercommunication system for pages and will have at least one input from the cafeteria for in room announcements. Provide a handheld wireless system. (Shure BLX or equivalent) The amplifier and wireless unit shall be housed in a ceiling equipment housing. (Middle Atlantic ECB2S or equivalent) The amplifier shall be sized to provide at least 15% head room.
- 2.39 Provide individual amplifier channels for each of the one way paging zones. These amplifiers shall have a minimum of 35 watts per channel with 70 volt or 25 volt outputs. The amplifier shall have gain controls for each channel to balance the separate paging zones. These amplifiers shall be sized to provide at least 10% head room for the speakers they are powering.

2.40 Provide free standing enclosed rack with 35 rack spaces and low profile caster base. Rack should include 1 rack shelf for owner provided audio source and appropriate mounted power strip for all equipment housed in the rack. Use flanged blank panels to close in the open spaces in the rack.

## MASTER CLOCK

- 2.41 Provide an integral Master Clock facilities shall be directly connected to the internal data bus structure of the Communication System allowing operation and programming under the same software package. Systems requiring a separate Master Clock assembly with a separate software program hardwired into the intercom component of the system will not be accepted. The Master Clock shall provide the following functions:
  - 2.41.1 Computer interface for on or off site programming.
  - 2.41.2 Capacity for 1024 events and up to 15 holidays.
  - 2.41.3 Events shall be programmable to any one or all of eight schedules to allow flexibility due to season, short day or special events.
  - 2.41.4 Fully automatic running schedules. Programming of specific schedule(s) to specific day(s).
  - 2.41.5 Capability of reviewing, editing or deleting events.
  - 2.41.6 Facilities for automatic distribution of program material during class change periods.
  - 2.41.7 Crystal controlled time base for accuracy.
  - 2.41.8 Super Cap for back up of time keeping function. Systems requiring batteries for basic memory storage will not be accepted.
- 2.41 Provide stand alone battery operated radio controlled (Atomic) clocks. The clocks shall sync with the NIST system and correct automatically for daylight savings time. The clocks shall be provided with optional boosted battery packs for 5-years of maintenance free operation. Provide 12 inch analog clocks in the class room areas as indicated on the drawings.
- 2.41 Provide POE digital clocks as indicated on drawings. The clocks shall sync with the NIST system and correct automatically for daylight savings time. The digital clocks shall connect to the network with DHCP or static IP addressing. The clock digits shall be 4 inch high red numbers and can be configured for either 12h or 24hr display. Wire guards shall be provided in the gym.

# PART 3 CABLES

3.0 All new cable shall be listed for the intended purpose. Use CAT 3/5/5e/6, 24AWG, U.L. Listed cable. Home run all station wiring in individually jacketed cables. Number of pairs within the cable may vary due to specific field conditions.
- 3.1 All interior staff station wiring shall be in accordance with current new construction wiring guidelines published by the manufacturer, including staff speaker and call switch.
- 3.2 All interior Administrative phone(s) shall be wired in accordance with current new construction wiring guidelines published by the manufacturer.
- 3.3 All operator displays shall be connected to the system in accordance with current new construction wiring guidelines published by the manufacturer.
- 3.4 All power amplified speaker circuits shall be connected using one twisted pairs 18ga min in an overall jack.
- 3.5 All constant voltage speaker circuits shall be connected using a separate twisted shielded pair. Refer to drawings for proper wire gauge.
- 3.6 Transient suppression is required on all wiring leaving the building.
- 3.7 All cables run in underground conduits must be suited for wet locations.

### PART 4 INSTALLATION

- 4.0 Complete system shall be installed in strict accordance with the recommendation of the manufacturers as approved by the Architect, anchoring all components firmly into position or long life under hard use.
- 4.1 System equipment locations shown on the Drawings are approximate. Verify exact location s in the field and coordinate these with the Architect.
- 4.2 After the systems have been completely tested, the cables between the sound system equipment cabinet conduit access boxes and the sound system equipment cabinets shall be neatly bundled and held with either nylon lacing cord or nylon cable clamping devices similar to Thomas & Betts "Ty-Rap". More than one bundle may be used if one bundle would be too large to be workable. Provide sufficient loop in the bundle to allow moving the equipment cabinets away from the wall for servicing. Cable bundle(s) shall be securely attached to the equipment.

### PART 5 INSPECTIONS AND TEST UPON COMPLETION

- 5.0 Check out of the installation shall be made by the contractor. The system shall be free of short circuits, ground loops, parasitic oscillations, excessive system noise and hum, and instability. The Contractor shall, at his own expense, make any changes required to meet these performance requirements.
- 5.1 Check-out and final connections to the system shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.
- 5.2 System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.
- 5.3 All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and test.
- 5.4 Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall

include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.

- 5.5 Upon completion of the installation of the equipment, the electrical contractor shall provide to the engineer a signed statement form the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.
- 5.6 Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The engineer will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

END OF SECTION 275123

SECTION 275130 - MULTIMEDIA AND AV SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. The Electrical Contractor is to furnish all materials, equipment, labor, professional services and instrumentation necessary to provide and install the system as herein described and indicated on the drawings.
- B. This Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects one-year warranty from date of installation.
- C. The contractor shall furnish gratis to the owner a one year warranty effective from date of installation for maintenance and inspection service of the manufacturer's equipment with a minimum of two inspections during the contract year.
- D. The Equipment Supplier shall show satisfactory evidence upon request that he maintains, within a fifty-mile radius of the project, a fully equipped service organization with standard replacement parts. All installation and service performed shall be by qualified personnel.
- E. All bids shall be based on equipment herein mentioned and specified. All substitute equipment shall be prequalified in writing (by addenda) by the Engineer, no later than fifteen days prior to bid date. The substitute equipment supplier shall furnish, to the Engineer, system riser diagrams, engineering data and or samples of the alternate equipment, supporting compliance with the specifications, for prequalification.
- F. All systems provided under this section shall be furnished with a one-year warranty by the Contractor and longer factory warranties as available in standard products.
- G. Contractor Qualifications: Contractor shall have been in the AV business and performed similar installations for a minimum of 5 years. Contractor is to be located within 20 miles of

project. Contractor must be able to provide a list of five projects equal in size and function of this project.

H. System shall be provided by a single source: Sol-Tek – Mr. Steve Boyer – 812-963-9180.

# PART 2 - PRODUCTS

- 2.1 The AV System for these areas shall provide the ability to display computer graphics as well video materials. The systems shall be integrated into the local sound systems for smooth even direct coverage throughout the seated areas. Inputs shall be provided on the wall for a direct HDMI connection. The HDMI connections may be active, passive, fiber, or twisted pair depending on the location and cable lengths. The contractor shall responsible for guaranteeing the supplied option works for the application present. A wireless video connection unit shall be provided to allow connection of laptops, tablets, and mobile devices. A wall control unit shall be present in each area to allow simple control of the AV system without the use of a remote. The controller shall be programmed and connected in manner to allow the AV system to be turned on or off with one button push. The controller will also provide volume control of the media being presented.
- 2.2 The equipment in this section is specified by manufacturer part number. The contractor shall be responsible for researching the individual equipment items and making sure that equipment supplied will work as a complete system as outlined above. Any equipment items which become obsolete before the completion of the project shall be replaced by a product which meets or exceeds the item specified. Any errors or omissions will not relieve the contractor of providing a complete and functional system. Items which require rack kits or supplemental interface kits shall be supplied shall be supplied with thos kits as required.
- 2.3 Approved manufacturers for the AV system equipment are Extron, AMX, Barco, NEC, Panasonic, Sony, Chief, DaLite, Draper, Middle Atlantic, Cables to Go, and WePresent.

### 2.4 CAFÉ AV SYSTEM

- A. Wall controller Extron MLC 62 RS D
- B. Projector NEC NP-PA672W-13ZL
- C. Projector Mount Chief KITES-003W
- D. Screen DaLite 70118LS
- E. Wireless WePresent WIPG-1500
- F. Wall Plate C2G 41034 (Verify Color)

MULTIMEDIA AND AV SYSTEMS

- G. Cables 20' HDMI C2G 29682 with C2G 54322
- H. Audio Reference Intercom Spec Section 2.33.1 and 2.38
- 2.5 LECTURE HALL AV SYSTEM
  - A. Wall controller Extron MLC 62 RS D
  - B. Projector NEC NP-PA672W-13ZL
  - C. Projector Mount Chief KITES-003W
  - D. Screen DaLite 70118LS
  - E. Wireless WePresent WIPG-1500
  - F. Wall Plate C2G 41034 (Verify Color)
  - G. Cables 20' HDMI C2G 29682 with C2G 54322
  - H. Audio Reference Intercom Spec Section 2.33.1 and 2.38

# 2.6 GYM AV SYSTEM

- A. Wall controller Extron MLC 62 RS D
- B. Projector Barco F90-W13
- C. Projector Lens Barco EN16
- D. Projector Mount Chief VCMUW
- E. Projector Wall Mount Chief WMA2S
- F. Projector Guard Custom Made (Similar to Chief PGA3A)
- G. Screen DaLite 70275L
- H. Wireless WePresent WIPG-1500
- I. Wall Plate C2G 29374 (Verify Color)
- J. Cables 20' HDMI C2G 29682 with C2G 54322
- K. Audio Reference Gym PA Spec
- L. Audio Tie Line MuxLab 500030 & 500028

# PART 3 CABLES

- 3.0 All cable shall be new and listed for the intended purpose. Approved manufacturers include West Penn Wire, Belden and American Data Link.
- 3.1 All mic/line cable shall be 20ga twisted pr in a 95% overall foil shield.
- 3.2 Use CAT6 cable for twisted pair equipment.
- 3.3 Use premade HDMI cable were possible rated for the area in which they will be installed.
- 3.4 Transient suppression is required on all wiring leaving the building.
- 3.5 All cables run in underground conduits must be suited for wet locations.

# PART 4 INSTALLATION

- 4.1 Complete system shall be installed in strict accordance with the recommendation of the manufacturers as approved by the Architect, anchoring all components firmly into position or long life under hard use.
- 4.2 System equipment locations shown on the Drawings are approximate. Verify exact locations in the field and coordinate these with the Architect.
- 4.3 After the systems have been completely tested, the cables shall be neatly bundled and held with either nylon lacing cord or nylon cable clamping devices similar to Thomas & Betts "Ty-Rap". More than one bundle may be used if one bundle would be too large to be workable. Provide sufficient loop in the bundle to allow moving the equipment cabinets away from the wall for servicing. Cable bundle(s) shall be securely attached to the equipment.

# PART 5 INSPECTIONS AND TEST UPON COMPLETION

- 5.0 Check out of the installation shall be made by the contractor. The system shall be free of short circuits, ground loops, parasitic oscillations, excessive system noise and hum, and instability. The Contractor shall, at his own expense, make any changes required to meet these performance requirements.
- 5.1 Check-out and final connections to the system shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition,

#### MULTIMEDIA AND AV SYSTEMS

factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

- 5.2 System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.
- 5.3 All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and test.
- 5.4 Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.
- 5.5 Upon completion of the installation of the equipment, the electrical contractor shall provide to the engineer a signed statement form the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.
- 5.6 Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The engineer will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

END OF SECTION 275130

# SECTION 275210 – ENTRY DOOR VIDEO INTERCOM SYSTEM

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. The Electrical Contractor is to furnish all materials, equipment, labor, professional services and instrumentation necessary to provide and install the system as herein described and indicated on the drawings.
- B. This Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects one-year warranty from date of installation.
- C. The contractor shall furnish gratis to the owner a one year warranty effective from date of installation for maintenance and inspection service of the manufacturer's equipment with a minimum of two inspections during the contract year.
- D. The Equipment Supplier shall show satisfactory evidence upon request that he maintains, within a fifty-mile radius of the project, a fully equipped service organization with standard replacement parts. All installation and service performed shall be by qualified personnel.
- E. All bids shall be based on equipment herein mentioned and specified. All substitute equipment shall be prequalified in writing (by addenda) by the Engineer, no later than fifteen days prior to bid date. The substitute equipment supplier shall furnish, to the Engineer, system riser diagrams, engineering data and or samples of the alternate equipment, supporting compliance with the specifications, for prequalification.
- F. All systems provided under this section shall be furnished with a one-year warranty by the Contractor and longer factory warranties as available in standard products.
- G. Contractor Qualifications: Contractor shall have been in the AV business and performed similar installations for a minimum of 5 years. Contractor is to be located within 20 miles of project. Contractor must be able to provide a list of five projects equal in size and function of this project.
- H. System shall be provided by a single source: Sol-Tek Mr. Steve Boyer 812-963-9180.

## PART 2 - PRODUCTS

- 2.1 The door entry system shall provide the ability to display, view, and communicate with visitors seeking entry into the building. The video door phone shall be interconnected with the door lock so someone inside the building can grant acces to the person entering the building.
- 2.2 The equipment in this section is specified by manufacturer part number. The contractor shall be responsible for researching the individual equipment items and making sure that equipment supplied will work as a complete system as outlined above. Any equipment items which become obsolete before the completion of the project shall be replaced by a product which meets or exceeds the item specified. Any errors or omissions will not relieve the contractor of providing a complete and functional system. Items which require rack kits or supplemental interface kits shall be supplied shall be supplied with thos kits as required.
- 2.3 The approved manufacturer for the Door Entry System is Comelit.
- 2.4 ENTRY DOOR INTERCOM SYSTEM
  - A. Door Entry Station Comelit EX-DSQ
  - B. Monitor Comelit EX-7000H
  - C. Monitor Desk Stand Comelit CDSK
  - D. Central Bus Unit Comelit 1209/4
  - E. Expander Module Comelit 1405

#### PART 3 CABLES

- 3.0 All cable shall be new and listed for the intended purpose. Approved manufacturers include West Penn Wire, Belden and American Data Link.
- 3.2 Use CAT5/6 cable for twisted pair equipment.
- 3.4 Transient suppression is required on all wiring leaving the building.
- 3.5 All cables run in underground conduits must be suited for wet locations.

## PART 4 INSTALLATION

Complete system shall be installed in strict accordance with the recommendation of the manufacturers as approved by the Architect, anchoring all components firmly into position or long life under hard use.

- 4.1 System equipment locations shown on the Drawings are approximate. Verify exact location s in the field and coordinate these with the Architect.
- 4.2 After the systems have been completely tested, the cables between the system equipment cabinet conduit access boxes and the system equipment cabinets shall be neatly bundled and held with either nylon lacing cord or nylon cable clamping devices similar to Thomas & Betts "Ty-Rap". More than one bundle may be used if one bundle would be too large to be workable. Provide sufficient loop in the bundle to allow moving the equipment cabinets away from the wall for servicing. Cable bundle(s) shall be securely attached to the equipment.

# PART 5 INSPECTIONS AND TEST UPON COMPLETION

- 5.0 Check out of the installation shall be made by the contractor. The system shall be free of short circuits, ground loops, parasitic oscillations, excessive system noise and hum, and instability. The Contractor shall, at his own expense, make any changes required to meet these performance requirements.
- 5.1 Check-out and final connections to the system shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.
- 5.2 System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.
- 5.3 All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and test.
- 5.4 Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.
- 5.5 Upon completion of the installation of the equipment, the electrical contractor shall provide to the engineer a signed statement from the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.

5.6 Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The engineer will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

END OF SECTION 275210

# SECTION 276020 – CABLE TV VIDEO DISTRIBUTION CABLING SYSTEMS

PART 1- GENERAL

- 1.1 SUMMARY
  - A. This specification includes all labor and material as required to provide cable TV video distribution system cabling infrastructure within the Project Area.
  - B. The extent of the cable TV video distribution system shall include all material and labor as required to connect cable TV outlets to the main data/communication room. The video distribution system shall include: data cable, device plates, jacks, connectors, terminations, cable support slings and J-hooks, ancillary equipment, testing, and as-built record documents. The cable TV video distribution cabling system shall also include all material and labor as required to provide additional conduit sleeves (which are not shown on the Contract Drawings) and are required to provide a path for installation of cable TV video distribution system cabling.
  - C. The installation shall include fire stopping of all sleeves and cable trays which penetrate fire walls and floors.
  - D. Contractor shall refer to Division 27 Section "Structured Voice & Data Cabling Systems" for additional requirements on performance of the data cable required to be provided to each TV outlet location.
  - E. Abbreviations: The following abbreviations are used within this document.
    - 1. Mhz Megahertz
    - 2. dB Decibel
    - 3. BICSI Building Industry Consulting Services International
    - 4. ANSI American National Standards Institute
    - 5. TIA/EIA Telecommunications Industry Association/Electronic Industries Association.

#### 1.2 SUBMITTALS

- A. Product Data:
  - 1. Submit manufacturer's technical data and cut sheets for all:
    - a. Equipment
    - b. Components
    - c. Wire management systems (J-hooks, Slings, etc)
    - d. Connectors
    - e. Cable
    - f. Identification labels
  - 2. Submit product data and UL method for fire stopping of sleeves and cable tray penetrations.
- B. Test Data: Submit test data for items as outlined in paragraph QUALITY ASSURANCE.
- C. Warranties: Submit a copy of warranties for all cabling and equipment. This information shall be included in the maintenance manual.

- D. Shop drawings:
  - 1. Shop drawings shall also include details of proposed U.L. listed fire stopping for penetrations of fire walls and floors.
- E. Maintenance Manual: Provide a quantity of Two (2) maintenance manuals which shall include all the items identified in paragraphs 1.2.A. through 1.2.D. The maintenance manuals shall also include product manuals for all equipment provided. Maintenance manuals shall also include "AS-BUILT" documentation, and phone numbers for repair, maintenance, and replacement parts.
- F. As-Built Documentation:
  - 1. "AS-BUILT" documentation shall be assembled in loose leaf binders and shall include:
    - a. System Schematic Diagrams.
    - b. System wiring lists and AUTOCAD floor plans that indicate device location & identification. Provide full size (i.e. 1/8" = 1'-0" scale) hard copy drawings and AUTOCAD drawing files on CDROM.
    - c. Documentation shall be neatly organized.

### 1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of video distribution systems and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Installer(s) shall be electricians and shall have at least 5 years of successful installation experience with projects utilizing video distribution systems, and equipment similar to that as specified for this project.
- C. Codes and Standards: All installation shall be in accordance with the National Electrical Code.
- D. IEEE Compliance: Installations shall comply with Std 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to communication systems.
- E. Testing: Video Distribution installation shall be tested as described below. Results of these tests shall be documented and submitted to the engineer and owner for review. Test data shall also be included in the maintenance manuals described in section SUBMITTALS.
  - 1. Data cables shall be tested to the test / performance requirements as specified in Division 27 Section "Structured Voice & Data Cabling Systems".
  - 2. A hard copy print out of test results shall be provided as part of the O&M manuals. The test results for each channel shall be on a separate sheet. The test data sheets shall be arranged in numerical order for easy reference.
  - 3. Test Equipment: Test equipment shall have a minimum of 10 dB better margin than the required performance limits to ensure accuracy of test results. Test equipment which does not meet this requirement is not acceptable.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. All equipment and cabling shall be delivered to the site in factory fabricated containers or wrappings, which shall properly protect equipment and cabling from damage.
- B. Store equipment and cabling in original packaging. Store indoors in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.
- C. Handle equipment and cabling carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged equipment or cabling. Damaged equipment and cabling shall be replaced with new.

#### 1.5 SEQUENCING AND SCHEDULING

A. Coordinate installation with the work of all other trades involved with the construction project. This coordination shall include participation in weekly construction progress meetings before and during actual installation of equipment and cabling. Contractor shall coordinate cable installation routes with all other trades. No extra compensation will be allowed for removal/reinstallation of cable, supports or other equipment which is in the way of other trades. It shall be the contractor's responsibility to keep informed of the work and space requirements of all other trades. It shall also be the contractor's responsibility to inform all other trades of the proposed cable routes, hanger, locations, and other equipment installation.

## 1.6 MAINTENANCE & WARRANTIES

- A. Warranties:
  - 1. The contractor shall provide a 1 year warranty of materials and workmanship, providing for labor and materials to correct any defects found before and after substantial completion of the project. The warranty period shall begin at the time of completion or at the time the Owner first receives beneficial use, whichever comes first. Start of warranty shall be issued in writing to the owner and owner's representative.
  - 2. See Division 01 Specifications for additional warranty requirements.

### PART 2 - PRODUCTS

### 2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with the requirements, provide products by one of the manufacturers identified below. No substitutions will be acceptable without written approval prior to opening of bids.
  - 1. Data cabling, patch panels, terminations, etc.: Refer to Division 27 Section "Structured Voice & Data Cabling Systems" for additional requirements on acceptable manufacturers for data system infrastructure required to be provided to each TV outlet location

## 2.2 DEVICE PLATES - VIDEO DISTRIBUTION SYSTEM

- A. Device plates for video distribution outlet locations shall be plastic with the same color finish as specified for wiring devices within Division 26 section "Wiring Devices".
- B. Provide device plates which support the quantity and types of jacks at each location, unless noted or specified otherwise on the Contract Drawings.
- C. Provide blank device plates for all video outlet locations left empty by this contract.

## 2.3 CABLE SUPPORTS

- A. Large Bundle Supports. Caddy Cat. No. 425, UPC No. 33179, or approved equal or better.
- B. J-hook Supports. Category 5.

## 2.4 DATA SYSTEM INFRASTRUCTURE REQUIREMENTS

A. Refer to Division 27 Section "Structured Voice & Data Cabling Systems" for additional requirements on performance of the data cable system infrastructure required to be provided to each TV outlet location.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

A. Examine areas and conditions under which the instructional technology video distribution system cabling is to be installed. Notify the owner and owner's representative in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected.

### 3.2 COORDINATION

A. Coordinate all equipment layouts and installation within communications rooms with the engineer and Owner's I.T. Staff prior to purchase of equipment.

### 3.3 DATA SYSTEM INFRASTRUCTURE INSTALLATION REQUIREMENTS

A. Refer to Division 27 Section "Structured Voice & Data Cabling Systems" for additional requirements on installation, labelling and testing requirements for the data cabling infrastructure required to be provided to each TV outlet location.

### 3.4 FIRE-STOPPING

A. Provide UL listed fire stopping in all sleeves through floors and fire/smoke-n-fire rated walls. Contractor shall fire stop all sleeves, this includes spare sleeves left empty for future use. END OF SECTION 276020

## SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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. Electronic safety and security equipment coordination and installation.
  - 2. Sleeves for pathways and cables.
  - 3. Grout.
  - 4. Fire and Smoke Stopping
  - 5. Common electronic safety and security installation requirements.

### 1.3 SUBMITTALS

A. Product Data: For sleeve seals.

#### 1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of communications equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting pathways, cables, wireways, and cable trays will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.
- D. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07 Section "Penetration Fire-stopping."

### PART 2 - PRODUCTS

#### 2.1 SLEEVES FOR PATHWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.

#### 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

### 2.4 FIRE STOPPING

A. Fire and smoke stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire Stopping".

### PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when pathways, cables, wire-ways, or cable trays penetrate concrete slabs, concrete or masonry walls, smoke & fire-rated floor and wall assemblies, or any non-fire rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Smoke & Fire-Rated Assemblies: Install sleeves for penetrations of smoke and/or fire-rated floor and wall assemblies unless openings compatible with fire-stop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 12 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
- J. Smoke and Fire-Rated-Assembly Penetrations: Maintain indicated smoke and fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with fire-stop materials. Comply with requirements in Division 07 Section "Penetration Fire-stopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SMOKE AND FIRE-STOPPING

- A. Apply fire-stopping to penetrations of smoke and fire-rated floor and wall assemblies for communications installations to restore original smoke & fire-resistance rating of assembly. Fire-stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire-stopping."
- B. Seal around outside of sleeves and conduits which penetrate smoke and fire rated floor and wall assemblies.
- C. Seal the inside of sleeves and conduits that penetrate smoke and fire rated floor and wall assemblies, after cables have been installed.

END OF SECTION 280500

### SECTION 281300 - RACEWAYS FOR ACCESS CONTROL SYSTEM CABLING & EQUIPMENT

PART I – 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 all labor and materials as required to provide empty conduit raceway systems for access control system equipment and cabling. In addition to providing empty conduit raceway systems, the Contractor will be required to coordinate the raceway installation locations and requirements with the Owner's access control system provider.
- B. The Owner's access control system provider will provide all required cabling and equipment.
- C. This specification also includes all materials as required to provide conduits (which are not shown on the Contract Drawings) thru walls to provide a pathway for installation of access control system cables.
- 1.3 SUBMITTALS (None Required)

#### 1.4 RELATED SECTIONS

- A. Related Sections include the following:
  - 1. Division 26 Section 260533 "Raceway and Boxes for Electrical Systems" for conduit types.

#### PART 2 – PRODUCTS

2.1 See Section 260533 "Raceway and boxes for Electrical Systems" for conduit types and requirements.

### PART 3- EXECUTION

- 3.1 INSTALLATION, GENERAL
  - A. Furnish and install raceways and boxes in accordance with the requirements of the Owner's access control system provider.
  - B. Coordinate the exact installation locations, mounting heights, and requirements with the Owner's access control system provider prior to purchase of materials and start of roughin.
- 3.2 COORDINATION
  - A. Coordinate all raceway installation requirements with the other trades involved with this project.

END OF SECTION 281300

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

### SECTION 281300 – ACCESS CONTROL SYSTEM

### PART I – 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 security access systems, and all required labor and materials and accessories required to provide a complete and operable extension to the existing security access control system installed at the site.
  - 1. This section includes providing (and coordinating requirements of) all required power and control equipment and circuits required for use with door hardware systems furnished and installed by Division 08710 Contractor.
- B. Equipment furnished and installed by other Contractors.
  - 1. Refer to Division 087400 for information on Door Hardware Equipment.
- C. Related Sections include the following:
  - 1. Division 08 Section 087400 for door hardware furnished by the General Contractor and requiring power and control circuits provided by the Electrical Contractor.
  - 2. Division 26 Sections for requirements on 120V power circuits & conduit raceways and labeling requirements.

#### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

#### 1.2 SYSTEM DESCRIPTION

- A. General: Provide a complete and operable access control system that is fully compatible with the existing access control system and software that is currently in-use at the site.
- B. System Power Requirements
  - 1. All required controllers shall be provided with and shall operate on 120VAC power source via a dedicated 20 Ampere branch circuit fed from a panel connected to the emergency generator and flywheel UPS distribution system.
  - 2. All low voltage power/control circuits requiring system-operating power shall be 24VDC and shall be individually fused at the control panel. **Contractor shall be responsible for coordinating voltage requirement with door hardware provider.**

### 1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of Contract and Division 01 Specification Sections.
  - 1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification.

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- 2. Point to point wiring diagram indicating control panels and equipment, alarm indicating devices, alarm initiating devices, card readers. Circuits shall be shown and shall include the number and type of conductors which are required to be provided between each device and/or control panel. CAD generated drawings shall be submitted in accordance with Conditions of Contract and Division 01 specification Sections. Hand generated drawings will not be accepted.
- 3. Operation and maintenance data for inclusion in Operating and Maintenance Manuals. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organization.
- 4. Record of field test of system.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installers shall be local factory authorized to furnish and install all equipment and materials required under this section. The following installers are acceptable for this project:
  - 1. Advanced Systems Technology, Inc.

Mr. Jerry Thomas, Telephone: 812-476-5534

- B. Single-Source Responsibility: Obtain all access control system equipment and materials from a single source who assumes responsibility for compatibility of system components with both the new and existing installations on the project site.
- C. Comply with all applicable building codes, local ordinances and regulations, and the requirements of the authorities having jurisdiction.
- D. Warranty. The access control system, equipment and installation shall be warranted against all defects in material and workmanship.
  - 1. Warranty Period: 2 years.
  - 2. Reference Division 01 Specification section for additional requirements on warranty requirements including but not limited to, start of warranty period.

### PART 2 – PRODUCTS

- 2.1 MANUFACTURERS: Subject to compliance with the requirements, provide products by one of the following manufacturers listed in the paragraphs below. (No Substitutes will be accepted). <u>Note:</u> All equipment and installation shall be fully compatible with the existing Access system that is currently installed at the site.
  - A. System Integrator/Vendor: The access control system shall be purchased through one of the following system integrators/vendors:
    - Advanced Systems Technology, Inc. P.O.C Mr. Jerry Thomas Tel: 812-464-5514
  - B. Existing System:

ACCESS CONTROL SYSTEM

1. The existing access control security management system is manufactured by Northern Computer, Inc. All new equipment shall be fully compatible with the existing system and manufactured by Northern Computer, Inc.

# PART 3- EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Install system in accordance with applicable NFPA standards and in accordance with the system manufacturer's requirements.
- B. Coordinate the exact installation locations and mounting heights of all equipment in field with architect prior to rough-in to ensure proper operation of system with attention to architectural detail.

### 3.2 COORDINATION

- A. Coordinate all installation requirements with the other trades involved with this project. Coordinate ratings and requirements of equipment and hardware furnished by others to ensure compatibility with the security access system.
  - 1. Coordinate voltage requirement and capacity issues of door hardware equipment with the voltage & capacity requirements of the Access Control System equipment and with the door hardware provider.

### 3.3 EQUIPMENT COORDINATION

- A. Coordinate equipment requirements with door hardware equipment provider. Provide all equipment and devices as required to provide a complete and operable access control system. Types of equipment to be provided under this specification section includes, but is not limited to:
  - 1. Door Position Switches.
  - 2. Request-to-Exit Motion Sensor Devices.
  - 3. Card Readers.
  - 4. Controllers.
  - 5. Power Supplies.
  - 6. Cabling.
  - 7. Software & Programming.

### 3.4 WIRING INSTALLATION

- A. Wiring Method:
  - Install all line voltage (120V) power conductors within metal raceway according to Division 26 Section "RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS." Conceal raceway except in unfinished spaces and as indicated.
    - a. Use THWN type copper conductors for all 120V power circuits.

- 2. Low voltage alarm and communication wiring will not be required to be installed within conduit raceways, except for the following locations:
  - a. In locations where cabling is routed through/within mechanical and electrical rooms.
  - b. Use separate conduits for low voltage and line voltage conductors.
- B. Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the security access system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color Coding:
  - 1. Color-code security access system cables differently from the building temp control, fire alarm, voice, data, and video systems cables.
  - 2. Use one color code for security access system low voltage cables.
- E. Provide all required power connections and circuits to access control panels as required to form a complete and operable system.
- F. Provide all required low voltage cables and circuits between control panels, auxiliary panels, power supplies, and devices as required to form a complete and operable system.

### 3.5 GROUNDING:

- A. Ground cable shields and equipment according to system manufacturer's instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

### 3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of access control systems.

# 3.6 PROGRAMMING

A. Provide all labor and materials as required and provide modifications to the existing access control system program as required to meet project requirements.

END OF SECTION 281300

ACCESS CONTROL SYSTEM

SECTION 282300 - VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

### 1.2 SUMMARY

- A. This Section includes all labor, material, licenses, and all other items as required to provide a complete POE type video surveillance system, including but not limited to: data cabling, patch panels, terminations, labelling, channel testing, camera assemblies, video servers, patch cords, system testing, camera aiming per Owner's requirements and Owner training.
  - 1. The Contractor shall include in their bid price the labor and material costs associated with using the Owners video surveillance system provider (i.e. Data Link) to furnish and install the required video surveillance system equipment (i.e. cameras, camera housings, patch cords, camera mounting accessories, video servers, camera & software licenses).
  - 2. The Contractor shall provide breakout costs (in their bid proposals) identifying the following costs:
    - a. Material Costs (Data Link's costs for materials & equipment):
      - (1) Cameras
      - (2) Servers
      - (3) Misc materials.
    - b. Labor Costs: (i.e. Data Link's costs for labor to install, aim, test and commission the cameras and video surveillance system).
    - c. Licenses Cost: (i.e. Data Link's costs for licenses for cameras, server software, and all other miscellaneous license costs).
    - d. The Contractor's percentage mark-up shall also be identified in their bid proposal.
  - 3. The Contractor shall provide Unit Costs (in their bid proposals) identifying unit pricing to provide 1 each of the following items:
    - a. Interior Camera (each type):
    - b. Exterior Camera (each type):
    - c. Video Server (each type):
    - d. The above units pricing shall have the following break-out prices for each unit price:
      - (1) Material Cost (Data Link's costs for materials & equipment).
      - (2) Labor Costs: (i.e. Data Link's costs for labor to install, aim, test and commission the cameras and video surveillance system).
      - (3) Licenses Cost: (i.e. Data Link's costs for licenses).

- e. The Contractor's percentage mark-up shall also be identified in their bid proposal.
- B. Programming of video surveillance system software, installation of cameras, aiming of cameras, programming of cameras shall be the responsibility of the Owner's video surveillance system provider (Data Link) and shall be included in their bid price.

## 1.3 RELATED SECTIONS

A. Division 27 Section 1– Structured Voice & Data Cabling Systems.

## 1.4 REFERENCES

- A. NFPA 70 National Electrical Code.
- 1.5 SUBMITTALS (See Division 27 Section "Structured Voice & Data Cabling Systems for submittal requirements).

## 1.6 WARRANTIES

- A. Warranty Video Surveillance System Equipment and Installation. The video surveillance system, equipment and installation shall be warranted against all defects in material and workmanship.
  - 1. Warranty Period: 2 years.
  - 2. Reference Division 01 Specification section for additional requirements on warranty requirements including but not limited to, start of warranty period.
- B. Warranty Structured Cabling System (See Division 27 Section "Structured Voice & Data Cabling Systems for requirements).

### 1.7 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in POE type video surveillance systems and equipment and with a minimum of five (5) years of experience.
- B. Installer: Company specializing in installation of video surveillance systems with a minimum of five (5) years of experience.
- A. Qualifications
  - 1. Contractor shall provide the services of the Owner's Video Surveillance System Provider (i.e. Data Link) to furnish and install the required video surveillance system equipment (i.e. cameras, camera housings, patch cords, video server, camera & software licenses).
    - a. Point of Contact: Data Link Mr. Kevin Koressel, Tel: 812-401-9946, Email: kkoressel@datalink.net.
  - C. See Division 27 Section "Structured Voice & Data Cabling Systems for additional requirements regarding the structured data system for the video surveillance system.

## 1.2 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections:
  - 1. Product Data for each type of system component specified.
  - 2. CAD floor plans which show camera locations and data closets where cameras are connected to.

## PART 2 – PRODUCTS

## 2.1 MANUFACTURERS

- A. Provide video surveillance system equipment and accessories from the manufacturer as indicated in the paragraphs below (NO SUBSTITUTES WILL BE ALLOWED).
- 2.2 SYSTEM SOFTWARE PLATFORM
  - A. Milestone XProtect Corporate 2014.
- 2.3 CAMERAS AND HOUSINGS INDOOR LOCATION (2MP)
  - A. Provide <u>AXIS M3045-V Network Camera</u>, HDTV 1080p / 2MP vandal & dust resistant fixed mini dome with HDMI support enabling streaming to a monitor, Axis Zipstream technology for reduced bandwidth and storage, Axis corridor Format.
  - B. Camera Capabilities:
    - 1. Image sensor: 1/3" progressive scan RGB CMOS.
    - 2. Lens: M12 mount, Fixed iris, Fixed focus, 2.8mm, F2.0.
    - 3. Light Sensitivity: 0.25 lux at 50 IRE F2.0
    - 4. Shutter Time: 1/32500 s to 1/5s
    - 5. Camera Angle Adjustment: +/- 177 degrees, Tilt +/- 69 degrees, Rotation +/- 176 degrees. Can be directed in any direction and see the wall/ceiling.
  - C. Video Capabilities:
    - 1. Video Compression:
      - (a) H.264 (MPEG-4 Part 10/AVC), Main, Baseline and High Profiles, Motion JPEG
    - 2. Resolutions:
      - (a) 1920x1080 (1080p) to 320x240,
      - (b) HDMI 1080p @25/30 fps (50/60Hz)
      - (c) HDMI 1080i @50/60 fps (50/60Hz)
      - (d) HDMI 720p @50/60 fps (50/60Hz)
      - (e) HDMI 720p @25/30 fps (50/60Hz)
    - 3. Frame Rate: 25/30 fps with power line frequency 50/60 Hz
    - 4. Video Streaming:
      - (a) Multiple, individually configurable streams in H.264 and Motion JPEG,

- (b) Controllable frame rate and bandwidth,
- (c) Axis Zipstream technology in H.264, VBR/MBR H.264 HDMI.
- 5. Multi-View Streaming: Up to 2 individually cropped out view areas in full frame rate.
- 6. Pan/Tilt/Zoom: Digital PTZ.
- 7. Image settings:
  - (a) Compression, color, brightness, sharpness, contrast, white balance, exposure control, exposure zones, backlight compensation, WDR, Text and image overlay, mirroring of images, privacy mask, Rotation: 0, 90, 180, 270 degrees including corridor format.
- D. Network Capabilities:
  - 1. Security:
    - (a) password protection,
    - (b) IP address filtering
    - (c) HTTPS encryption
    - (d) IEEE 802.1X network access control
    - (e) Digest Authentication
    - (f) User access log
    - (g) Centralized Certificate Management.
  - 2. Supported Protocols:
    - (a) IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, HDMI 1.4b
- E. System Integration Capabilities:
  - 1. Application Programming Interface.
    - (a) Open API for application integration including VAPIX and AXIS Camera application platform; specifications at www.axis.com
  - 2. Analytics
    - (a) Axis Video Motion Detection 3, Active tampering alarm support for Axis Camera application platform enabling installation of Axis cross line detection, Axis digital auto-tracking and third party applications.
  - 3. Event Triggers: Analytics, edge storage events.
- F. General.
  - 1. Casing: Color: White NCS S 1002-B, Encapsulated electronics, captive screws, IP42 water and dust resistant, IK08 impact resistant polycarbonate/ABS casing.
    - (a) Casing shall be capable of being painted in the field with custom paint colors to match the colors of the adjacent surfaces on which the camera is mounted.
  - 2. Memory:
    - (a) Memory: 512 MB RAM, 256 MB Flash
  - 3. Power:
    - (a) Camera: POE IEEE 802.3af/802.3at Type 1 Class 1 Typical 2.6W, max 3.0W
  - 4. Connectors

- (a) RJ45 Ethernet 10BaseT/100BaseTX(POE) HDMI Type D
- 5. Dimensions and Weight:
  - (a) Height: 2.2" (Below Finished Ceiling)
  - (b) Diameter: 4"
  - (c) Weight: 0.38 lbs.

### 2.4 CAMERAS AND HOUSINGS – INDOOR LOCATION (4MP)

- A. Provide <u>AXIS M3046-V Network Camera</u>, HDTV 1080p / 4MP vandal & dust resistant fixed mini dome with HDMI support enabling streaming to a monitor, Axis Zipstream technology for reduced bandwidth and storage, Axis corridor Format and 3-axis camera angle adjustment.
- B. Camera Capabilities:
  - 1. Image sensor: 1/3" progressive scan RGB CMOS.
  - 2. Lens: M12 mount, Fixed iris, Fixed focus, 2.4mm, F2.2.
  - 3. Light Sensitivity: 0.3 lux at 50 IRE F2.2
  - 4. Shutter Time: 1/32500 s to 1/5s
  - 5. Camera Angle Adjustment: +/- 177 degrees, Tilt +/- 65 degrees, Rotation +/- 176 degrees. Can be directed in any direction and see the wall/ceiling.
- C. Video Capabilities:
  - 1. Video Compression:
    - (a) H.264 (MPEG-4 Part 10/AVC), Main, Baseline and High Profiles, Motion JPEG
  - 2. Resolutions:
    - (a) 2688x1520 (1080p) to 320x240,
  - 3. Frame Rate: 25/30 fps with power line frequency 50/60 Hz
  - 4. Video Streaming:
    - (a) Multiple, individually configurable streams in H.264 and Motion JPEG,
    - (b) Controllable frame rate and bandwidth,
    - (c) Axis Zipstream technology in H.264, VBR/MBR H.264 HDMI.
  - 5. Multi-View Streaming: Up to 2 individually cropped out view areas in full frame rate.
  - 6. Pan/Tilt/Zoom: Digital PTZ.
  - 7. HDMI Output:
    - (a) HDMI 1080p @25/30 fps (50/60Hz)
    - (b) HDMI 1080i @50/60 fps (50/60Hz)
    - (c) HDMI 720p @50/60 fps (50/60Hz)
    - (d) HDMI 720p @25/30 fps (50/60Hz)
  - 8. Image settings:
    - (a) Compression, color, brightness, sharpness, contrast, white balance, exposure control, exposure zones, backlight compensation, WDR, Text and image overlay, mirroring of images, privacy mask, Rotation: 0, 90, 180, 270 degrees including corridor format.

- D. Network Capabilities:
  - 1. Security:
    - (a) password protection,
    - (b) IP address filtering
    - (c) HTTPS encryption
    - (d) IEEE 802.1X network access control
    - (e) Digest Authentication
    - (f) User access log
    - (g) Centralized Certificate Management.
  - 2. Supported Protocols:
    - (a) IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, HDMI 1.4b
- E. System Integration Capabilities:
  - 1. Application Programming Interface.
    - (a) Open API for application integration including VAPIX and AXIS Camera application platform; specifications at www.axis.com
  - 2. Analytics
    - (a) Axis Video Motion Detection 3, Active tampering alarm support for Axis Camera application platform enabling installation of Axis cross line detection, Axis digital auto-tracking and third party applications.
  - 3. Event Triggers: Analytics, edge storage events.
- F. General.
  - 1. Casing: Color: White NCS S 1002-B, Encapsulated electronics, captive screws, IP42 water and dust resistant, IK08 impact resistant polycarbonate/ABS casing.
    - (a) Casing shall be capable of being painted in the field with custom paint colors to match the colors of the adjacent surfaces on which the camera is mounted.
  - 2. Memory:
    - (a) Memory: 512 MB RAM, 256 MB Flash
  - 3. Power:
    - (a) Camera: POE IEEE 802.3af/802.3at Type 1 Class 1 Typical 2.8W, max 3.2W
  - 4. Connectors
    - (a) RJ45 Ethernet 10BaseT/100BaseTX(POE) HDMI Type D
  - 5. Dimensions and Weight:
    - (a) Height: 2.2" (Below Finished Ceiling)
    - (b) Diameter: 4"
    - (c) Weight: 0.4 lbs.
- 2.5 CAMERAS AND HOUSINGS OUTDOOR LOCATION (5MP)
  - A. Provide <u>AXIS P3367-VE Network Camera</u>, HDTV 1080p / 5MP, P-Iris control, Remote Zoom & focus, I/O ports and two-way audio, Outdoor-ready and IK10 vandal resistance.

- B. Camera Capabilities:
  - 1. Image sensor: progressive scan RGB CMOS 1/3".
  - 2. Lens: 3-9mm, F1.2,
    - (a) Horizontal angle of view: 84 TO 30 degrees
    - (b) Vertical Angle of view: 63 to 22 degrees
    - (c) Varifocal, Remote focus and zoom, P-Iris control, IR corrected
  - 3. Day & night: Automatically removable infrared-cut filter
  - 4. Minimum Illumination: Color: 0.2 lux, F1.2, B/W: 0.04 lux, F1.2
  - 5. Shutter Time: 1/28000 s to 2s
  - 6. Camera Angle Adjustment: Pan: 360 degrees, Tilt: 160 degrees, Rotation: 340 degrees
- C. Video Capabilities:
  - 1. Video Compression:
    - (a) H.264 (MPEG-4 Part 10/AVC), Main, Baseline and High Profiles, Motion JPEG
  - 2. Resolutions:
    - (a) 2592x1944 (5MP) to 160x90,
  - 3. Frame Rate:
    - (a) 2MP 4:3 (1600x1200) and HDTV 1080p (1920x1080) capture modes: 30 fps in all resolutions.
    - (b) 3MP capture mode: 20 fps in all resolutions.
    - (c) 5MP capture mode: 12 fps in all resolutions.
  - 4. Video Streaming:
    - (a) Multiple, individually configurable streams in H.264 and Motion JPEG,
    - (b) Controllable frame rate and bandwidth,
    - (c) VBR/MBR H.264
  - 5. Multi-View Streaming: Up to 8 individually cropped out view areas in full frame rate.
  - 6. Pan/Tilt/Zoom: Digital PTZ, Preset positions, Guard Tour.
  - 7. Image settings:
    - (a) Compression, color, brightness, sharpness, contrast, white balance, exposure control, exposure zones, backlight compensation, fine tuning of behavior at low light, Text and image overlay, mirroring of images, privacy mask, Rotation: 0, 90, 180, 270 degrees including corridor format, wide dynamic range – Dynamic contrast.
- D. Audio Capabilities
  - 1. Audio Streaming: two-way audio.
  - 2. Audio Compression: AAC LC 8/16 KHz, G.711 PCM 8 KHz, G.726 ADPCM 8 KHz Configurable bit rate.
  - 3. Audio Input/Output: External microphone input or line input, Line Output.
- E. Network Capabilities:

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- 1. Security:
  - (a) password protection,
  - (b) IP address filtering
  - (c) HTTPS encryption
  - (d) IEEE 802.1X network access control
  - (e) Digest Authentication
  - (f) User access log
- 2. Supported Protocols:
  - (a) IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, SFTP, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH
- F. System Integration Capabilities:
  - 1. Application Programming Interface.
    - (a) Open API for application integration including VAPIX and AXIS Camera application platform; specifications at www.axis.com
  - 2. Analytics
    - (a) Video Motion Detection, Active tampering alarm, Audio detection support for Axis Camera application platform enabling installation of Axis video motion detection 3, Axis cross line detection, Axis digital auto-tracking and third party applications.
  - 3. Event Triggers: Analytics, edge storage events.
- G. General.
  - 1. Casing: Polycarbonate transparent dome, aluminum inner camera module with encapsulated electronics, IP66 and NEMA 4X rated, IK10 impact resistant casing with aluminum base and dehumidifying membrane. Color white NCS S 1002-B.
    - (a) Casing shall be capable of being painted in the field with custom paint colors to match the colors of the adjacent surfaces on which the camera is mounted.
  - 2. Memory:
    - (a) Memory: 512 MB RAM, 256 MB Flash
  - 3. Power:
    - (a) Camera: POE IEEE 802.3af/802.3at Type 1 Class 3 Max 12.1W
  - 4. Connectors
    - (a) RJ45 Ethernet 10BaseT/100BaseTX(POE)
    - (b) Terminal block for 1 alarm input and 1 output, 3.5mm mic/line in, 3.5mm line out.
  - 5. Dimensions and Weight:
    - (a) 7" x 4-5/8"
    - (b) Weight: 3.7 lbs with weather shield.
- 2.6 CAMERAS AND HOUSINGS INDOOR & OUTDOOR LOCATIONS (360 Degree multi-sensor)

- A. Provide <u>AXIS P3707-PE Network Camera</u>, four-cameras-in-one unit, HDTV 1080p / 8MP, flexible positioning of four varifocal camera heads, In-door & Outdoor-ready.
- B. Camera Capabilities:
  - 1. Image sensor: progressive scan RGB CMOS 4 x 1/2.8".
  - 2. Lens: varifocal, 2.8 6 mm, F2.0,
    - (a) 4 x 1080p capture mode:
      - (1) Horizontal field of view: 108 to 54 degrees
      - (2) Vertical field of view: 57 to 30 degrees
    - (b) 4 x HDTV 720p capture mode:
      - (1) Horizontal field of view: 67 to 36 degrees
      - (2) Vertical field of view: 37 to 20 degrees
    - (c) Adjustable focus and zoom, fixed iris
  - 3. Minimum Illumination: Color: 0.3 lux, F2.0
  - 4. Shutter Time:
    - (a) 720p: 1/28000 s to 2s
    - (b) 1080p: 1/22500 s to 2s
- C. Video Capabilities:
  - 1. Video Compression:
    - (a) H.264 (MPEG-4 Part 10/AVC), Baseline, Main and High Profiles, Motion JPEG
  - 2. Resolutions:
    - (a) 4 x 1920x1080 (1080p) to 160x90 quad view 1920 x 1440 to 480 x 270.
  - 3. Frame Rate:
    - (a) 25/30 fps (50/60Hz) with 720p capture mode,
    - (b) 12.5/15 fps (50/60Hz) with 1080p capture mode.
  - 4. Video Streaming:
    - (a) Multiple, individually configurable streams in H.264 and Motion JPEG,
    - (b) Axis zipstream technology in H.264
    - (c) Controllable frame rate and bandwidth,
    - (d) VBR/MBR H.264
  - 5. Image settings:
    - (a) Color, brightness, sharpness, contrast, white balance, exposure control, exposure zone, fine tuning behavior at low light' rotation overlay, privacy mask, local contrast.
  - 6. Camera angle adjustment:
    - (a) Pan: + / 90 degrees
    - (b) Tilt: 28 to 92 degrees
    - (c) Rotate: + / 90 degrees
- D. Network Capabilities:

- 1. IP address:
  - (a) One IP address for all channels.
- 2. Security:
  - (a) password protection,
  - (b) IP address filtering
  - (c) HTTPS encryption
  - (d) IEEE 802.1X network access control
  - (e) Digest Authentication
  - (f) User access log
  - (g) Centralized Certificate Management
- 3. Supported Protocols:
  - (a) IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, SFTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, SFTP, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH
- E. System Integration Capabilities:
  - 1. Application Programming Interface.
    - (a) Open API for application integration including VAPIX and AXIS Camera application platform; specifications at www.axis.com
  - 2. Analytics
    - (a) Video Motion Detection 3, Active tampering alarm support for Axis Camera application platform enabling installation of 3<sup>rd</sup> party applications.
  - 3. Event Triggers: Analytics, edge storage events.
- F. General.
  - 1. Casing: Polycarbonate transparent dome, aluminum inner camera module with encapsulated electronics, IP66, IP67, NEMA 4X and IK09 rated.
    - (a) Casing shall be capable of being painted in the field with custom paint colors to match the colors of the adjacent surfaces on which the camera is mounted.
  - 2. Memory:
    - (a) Memory: 1 GB RAM, 256 MB Flash
  - 3. Power:
    - (a) Camera: POE IEEE 802.3af/802.3at Type 1 Class 2 TYPICAL 4.8w, Max 5.5W
  - 4. Connectors
    - (a) RJ45 Ethernet 10BaseT/100BaseTX(POE)
  - 5. Dimensions and Weight:
    - (a) 10-5/8" (diameter) x 3-5/8" (height)
    - (b) Weight: 4.9 lbs.

### 2.7 VIDEO SERVERS

- 1. BCDVideo Nova Series, Professional Video Server, BCD212V0129-MP-C.
  - (a) Hard Drive Bays: Qnty 12 3.5" Bays
  - (b) RAM: 16GB
  - (c) Processor: XEON E5-2620V3
  - (d) Raid Controller: 4GB Controller with WIAP
  - (e) Passmark: 10094
  - (f) UPC: 857190006769
  - (g) Form Factor: 2U Rackmount
  - (h) Operating System: Windows Server 2012 R2
  - (i) Input Power: 120V
  - (j) BTU/HR: 2729
  - (k) Power Supplies: Qnty 2 800W
  - (I) Network Ports: Qnty 2 1GbE Ports
  - (m) Remote Access: iLO4
  - (n) Height: 3.45"
  - (o) Width: 18.93"
  - (p) Depth: 24.97"
  - (q) Weight (Max): 47lbs

## 2.8 STRUCTURED DATA SYSTEM

A. See Division 27 Section "Structured Voice & Data Cabling Systems for requirements.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Structured Data System Installation.
  - 1. See Division 27 Section "Structured Voice & Data Cabling Systems for requirements.
- B. Video Servers.
  - 1. Coordinate installation requirements with the Owner's I.T. Department.
  - 2. Provide quantity of servers as required to support the quantity of cameras provided as part of this project plus an additional quantity of 15 cameras.
  - 3. Provide redundant server to perform as a back-up server should the primary server fail.
  - 4. Install video servers within the 2<sup>nd</sup> floor Hospital Tower "A" main computer room. Install within the data equipment rack as directed by the Owner's I.T. department.
## C. Camera Assemblies.

- 1. Coordinate areas of coverage desired by the Owner (for each camera location) prior to installation of cabling and camera equipment. This coordination shall occur PRIOR TO submittal of CAD drawings showing the camera locations.
- 2. Install camera assemblies in accordance with the manufacturer's requirements.
- 3. Install camera assemblies which are rated for installation within the installed environments.
- 4. Provide custom painting of camera enclosures within the following installed locations.
  - a. Exterior Locations:
    - (1) All locations where the camera assembly is installed within, on or in front of non-white finishes.
  - b. Interior Locations:
    - (1) Main Street Areas where the camera assembly is installed within, on or in front of non-white finishes.
    - (2) Other Interior Locations where specifically noted on the Contract Drawings.
- 5. Provide all required accessories to install cameras in the locations as indicated on the Contract Drawings and the approved submittal drawings.

## 3.2 SYSTEM TESTING & COMMISSIONING

- A. Test all equipment for correct operation after installation.
- B. Aim cameras as required to provide coverage of spaces as directed by the Owner's security department.
  - 1. Provide labor and materials required to provide minor changes in general locations of cameras in the field as required to provide the video coverage required by the Owner.

## 3.3 CAMERA LICENSES

- A. Provide quantity of licenses as required for the quantity of cameras and servers provided on this project.
- B. A record copy of the licenses shall be included in the O&M Manuals provided at the completion of this project.
- 3.4 OWNER TRAINING
  - A. Provide on-site training of the Owner's staff to operate the video surveillance system and to understand the types of cameras provided on this project and the general capabilities of each type of camera.

END OF SECTION 282300

## SECTION 283111 – DIGITAL ADDRESSABLE FIRE ALARM SYSTEMS

PART 1.0 - GENERAL

- 1.1. DESCRIPTION:
- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, Ethernet and/or digital alarm communications to central stations and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
  - 1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.
- C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- D. The FACP and peripheral devices shall be manufactured or supplied 100% by a single U.S. manufacturer (or division thereof).
- E. Underwriters Laboratories Inc. (UL) USA:
  - No. 38 Manually Actuated Signaling Boxes
  - No. 50 Cabinets and Boxes
  - No. 864 Control Units for Fire Protective Signaling Systems
  - No. 268 Smoke Detectors for Fire Protective Signaling Systems
  - No. 268A Smoke Detectors for Duct Applications
  - No. 346 Waterflow Indicators for Fire Protective Signaling Systems
  - No. 464 Audible Signaling Appliances
  - No. 521 Heat Detectors for Fire Protective Signaling Systems
  - No. 1971 Visual Notification Appliances
- F. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.
- G. The FACP shall meet requirements of UL ANSI 864 Ninth Edition
- 1.2. SCOPE:
- A. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.
- B. Basic Performance:
  - 1. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.

- 2. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) as part of an addressable device connected by the SLC Circuit.
- 3. All circuits shall be power-limited, per UL864 requirements.
- 4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- 5. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.
- C. BASIC SYSTEM FUNCTIONAL OPERATION

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- 1. The system Alarm LED on the FACP shall flash.
- 2. A local sounder with the control panel shall sound.
- 3. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- 4. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over PSTN or Internet or Intranet via PSDN or virtual private network.

## 1.3. SUBMITTALS

## A. General:

- 1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
- 2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
- 3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.
- B. Shop Drawings:

- 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- 2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- 3. Show annunciator layout, configurations, and terminations.

## C. Manuals:

- 1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
- 2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
- 3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

## D. Software Modifications

- 1. Provide the services of a qualified technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
- 2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

## 1.4. GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

## 1.5. MAINTENANCE:

- A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
  - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
  - 2. Each circuit in the fire alarm system shall be tested semiannually.

- 3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 10.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- 1.6. POST CONTRACT EXPANSIONS:
  - A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
  - B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable beam detectors, addressable monitor modules and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
  - C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.
  - D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
  - E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.
- 1.7. APPLICABLE STANDARDS AND SPECIFICATIONS:

The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

A. National Fire Protection Association (NFPA) - USA:

No. 13 Sprinkler Systems
No. 70 National Electric Code (NEC)
No. 72 National Fire Alarm Code
No. 101 Life Safety Code
No. 38 Manually Actuated Signaling Boxes
No. 217 Smoke Detectors, Single and Multiple Station
No. 228 Door Closers–Holders for Fire Protective Signaling Systems

Jefferson Elementary School Henderson County Schools Henderson, Kentucky

- No. 268 Smoke Detectors for Fire Protective Signaling Systems
  No. 268A Smoke Detectors for Duct Applications
  No. 346 Waterflow Indicators for Fire Protective Signaling Systems
  No. 464 Audible Signaling Appliances
  No. 521 Heat Detectors for Fire Protective Signaling Systems
  No. 864 Control Units for Fire Protective Signaling Systems
  No. 1481 Power Supplies for Fire Protective Signaling Systems
  No. 1610 Central Station Burglar Alarm Units
  No. 1638 Visual Signaling Appliances
  No. 1971 Visual Signaling Appliances
  No. 2017 General-Purpose Signaling Devices and Systems
  1. The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.
- B. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- C. Local and State Building Codes.
- D. All requirements of the Authority Having Jurisdiction (AHJ).

## 1.8. APPROVALS:

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
  - UL Underwriters Laboratories Inc
  - FM Factory Mutual
  - MEA Material Equipment Acceptance (NYC)
  - CSFM California State Fire Marshal

## PART 2.0 PRODUCTS

- 2.1. EQUIPMENT AND MATERIAL, GENERAL:
  - A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.
  - B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
  - C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D. All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

## 2.2. CONDUIT AND WIRE:

## A. Conduit:

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
- 2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
- 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
- 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
- 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
- 6. Conduit shall be 3/4 inch (19.1 mm) minimum.
- B. Wire:
  - 1. All fire alarm system wiring shall be new.
  - 2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
  - 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
  - 4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).
  - 5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.

- 6. All field wiring (with exception of external communications Ethernet) shall be electrically supervised for open circuit and ground fault.
- 7. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.
- C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

#### 2.3. MAIN FIRE ALARM CONTROL PANEL:

- A. The FACP shall be a Fire-Lite Model MS-9200UDLS and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, Digital Dialer and Ethernet Communicators and other system controlled devices. Ethernet communications shall be via a Fire-Lite Model IPDACT. Central station supervisory equipment shall be a Teldat Corporation Visoralarm-Plus 2U listed to UL-864 standards.
- B. Operator Control
  - 1. Acknowledge Switch:
    - a. Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
    - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
  - 2. Alarm Silence Switch:

Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

3. Alarm Activate (Drill) Switch:

The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

4. System Reset Switch:

Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

5. Lamp Test:

The Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.

- C. System Capacity and General Operation
  - 1. The control panel shall provide, or be capable of, expansion to 198 intelligent/addressable devices.
  - 2. The control panel shall include Form-C Alarm, Trouble and Supervisory relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include programmable Notification Appliance Circuits (NACs) capable of being wired as NFPA Style Y (Class B) or NFPA Style Z (Class A).
  - 3. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
  - 4. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, a standard PS2-style PC keyboard or from a computer running upload/download software.
  - 5. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general alarm), have complicated programming (such as a diode matrix), are not considered suitable substitutes.
  - 6. The FACP shall provide the following features:
    - a. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
    - b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of

excessive smoke detector dirt or dust accumulation.

- c. The ability to display or print system reports.
- d. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
- e. Positive Alarm Sequence (PAS presignal), meeting NFPA 72 requirements.
- f. Rapid manual station reporting.
- g. Non-alarm points for general (non-fire) control.
- h. Periodic detector test, conducted automatically by the software.
- i. Walk test, with a check for two detectors set to same address.
- 7. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72), and California Code. Main panel notification circuits shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules

#### **B.** Central Microprocessor

- 1. The microprocessor shall be a state-of-the-art and it shall communicate with, monitor and control all external interfaces. A "watch dog" timer circuit to detect and report microprocessor failure.
- 2. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
- 3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.
- 4. A special program check function shall be provided to detect common operator errors.
- 5. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.
- 6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

## C. Local Keyboard Interface

- 1. In addition to an integral keypad, the fire alarm control panel will accept a standard PS2-style keyboard for programming, testing, and control of the system. The keyboard will be able to execute the system functions ACKNOWLEDGE, SIGNALS SILENCED, DRILL and RESET.
- D. Display
  - 1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
  - 2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
  - 3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, MAINTENANCE, ALARM SILENCED, DISABLED, BATTERY, and GROUND conditions.
  - 4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
  - 5. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.
- E. Signaling Line Circuit (SLC)
  - 1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (ionization, photoelectric or thermal) addressable Beam Detectors, and 99 addressable pull stations, intelligent modules (monitor or control) for a system capacity of 198 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
  - 2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
  - 3. The detector software shall meet NFPA 72, Chapter 10 requirements and be certified by UL as a calibrated sensitivity test instrument.

## F. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the EIA-232 communications standard.

- 2. One EIA-232 interface shall be used to connect an UL-Listed 80-column printer. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
- G. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.
- H. Digital Alarm Communicator Transmitter (DACT) and Internet Protocol Digital Alarm Communicator Transmitter (IPDACT). The DACT is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station. When the optional IPDACT Ethernet module is connected to the on board DACT, the system shall be capable of transmitting contact ID formatted alarms to a central station equipped with a compatible IP receiver via Ethernet over a private or public WAN/LAN, Intranet or Ethernet
  - 1. The IPDACT communicator shall be an integral module component of the fire alarm control panel enclosure.
  - 2. The IPDACT communicator shall include connections to the alarm panel's phone outputs and shall convert the contact ID protocol in DTMF form into UDP Ethernet Packets. It shall include the ability for simultaneous reporting of panel events up to three different IP addresses.
  - 3. The IPDACT communicator shall be completely field-programmable locally from a PC via a serial port or via Ethernet and Telnet.
  - 4. The IPDACT communicator shall be capable of transmitting events in contact ID format.
  - 5. Communication shall include vital system status such as:
    - Independent Zone (Alarm, trouble, non-alarm, supervisory)
    - Independent Addressable Device Status
    - AC (Mains) Power Loss
    - Low Battery and Earth Fault
    - System Off Normal
    - 12 and 24 Hour Test Signal
    - Abnormal Test Signal (per UL requirements)
    - EIA-485 Communications Failure
    - IP Line Failure
  - 6. The IPDACT communicator shall support independent zone/point reporting via the Contact ID format. In this format, the IPDACT shall support the transmission of addressable points within the system. This format shall enable the central station to have exact details concerning the location of the fire for emergency response. The IPDACT communicator shall be capable of providing simulated phone lines to the FACP and panel communication over IP shall be transparent to the panels normal operation over phone lines.
  - The IPDACT communicator shall utilize a supervisory heart beat signal of no less than once every 90 seconds insuring multiplexed level line supervision. Loss of Internet or Intranet connectivity shall be reported in no more than 200

seconds.

Alarm events shall be transmitted to a central station in no less than 90 seconds from time of initiation to time of notification.

- 8. The supervising station shall consist of a Teldat Corporation Visoralarm-Plus 2U receiver. Said receiver shall contain a smart card for backup of all account data. Backup smart card shall initiate a new receiver with all account information in Less than 60 seconds from power up.
- I. Stand Alone Voice Evacuation Control Panel
  - 1. A stand alone Voice Evacuation Control Panel shall be available from the same manufacturer of the main fire alarm system.
  - 2. This Voice Evacuation Control Panel shall work stand alone or as a slave to the Main Fire Alarm Control Panel.
  - 3. Shall have as minimum requirements:
    - a. Integral 25 Watt, 25 Vrms audio amplifier with optional converter for 70.7 volt systems. The system shall be capable of expansion to 50 watts total via the insertion of an additional 25 watt audio amplifier module into the same cabinet.
    - b. Speaker circuit shall be capable of either Class A or B wiring.
    - c. Integral Digital Message Generator with a memory capacity for up to 60 seconds of messaging. The Digital Message Generator shall be capable of producing five distinct messages (12 seconds each). These messages shall field programmable without the use of additional equipment.
    - d. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.
    - e. The Voice Evacuation Control Panel will be capable of detecting and annunciating the following conditions: Loss of Power (AC and DC), System Trouble, Ground Fault, Alarm, Microphone Trouble, Message Generator Trouble, Tone Generator Trouble, and Amplifier Fault.
  - The Voice Evacuation Control Panel shall be fully supervised including microphone, amplifier output, message generator, speaker wiring, and tone generation.
  - 5. Speaker outputs shall be fully power-limited.
  - 6. Amplifiers shall be independently powered and protected to eliminate a short on one circuit from affecting other circuits.
  - 7. The Voice Evacuation Control Panel shall provide full supervision on both active (alarm or music) and standby conditions.
  - 8. An optional zone splitter version shall be available that permits splitting speaker circuits into 8 specific zones.
  - 9. An optional distributed amplifier unit shall be available that permits splitting

speaker circuits into up to a total of 24 zones when two distributed amplifiers are combined with the master unit.

- 10. An optional fire fighter telephone unit with keypad shall be available that permits up to a total of 24 telephone circuits.
- J. Speakers:
  - 1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.25 to 2.0 Watts.
  - 2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m).
  - 3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
  - 4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
- K. Enclosures:
  - 1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected and painted red via the powder coat method with manufacturer's standard finish.
  - 2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
  - 3. The door shall provide a key lock and shall provide for the viewing of all indicators.
  - 4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure the panel to the enclosure back box.
- L. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances.
  - 1. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 18.0 amp hour batteries.
  - 2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay. Four NAC outputs, wired NFPA Style Y or Z, shall be available for connection to the Notification devices.
  - The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when either System Sensor, Wheelock or Gentex devices are installed.
  - 4. The FCPS shall function as a sync follower as well as a sync generator.
  - 5. The FCPS shall include a surface mount backbox.

- 6. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.
- 7. The FCPS shall provide 24 VDC regulated and power-limited circuitry per UL standards.
- M. Power Supply:
  - 1. The main power supply for the fire alarm control panel shall provide up to 6.0 amps of available power for the control panel and peripheral devices.
  - 2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
  - 3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
  - 4. The main power supply shall continuously monitor all field wires for earth ground conditions.
  - 5. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
- N. Programmable Electronic Sounders:
  - 1. Electronic sounders shall operate on 24 VDC nominal.
  - 2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
  - 3. Electronic sounders shall be flush or surface mounted as shown on plans.
- O. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
  - 1. The maximum pulse duration shall be 2/10 of one second.
  - 2. Strobe intensity shall meet the requirements of UL 1971.
  - 3. The flash rate shall meet the requirements of UL 1971.
- P. Audible/Visual Combination Devices:
  - 1. Shall meet the applicable requirements of Section A listed above for audibility.
  - 2. Shall meet the requirements of Section B listed above for visibility.
- Q. Specific System Operations
  - 1. Alarm Verification: Each of the intelligent addressable smoke detectors in the

system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.

- 2. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
- 3. Point Read: The system shall be able to display the following point status diagnostic functions:
  - Device status a.
  - Device type
  - b. c. Custom device label
  - d. Device zone assignments
- 4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
- 5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 1000 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory.

Systems that use volatile memory for history storage are not acceptable substitutes.

- 6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- 7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
- 8. The fire alarm control panel shall include Silent and Audible Walk Test functions - Silent and Audible. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
  - a. The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.
  - b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.
  - c. Introducing a trouble into the initiating device shall activate the programmed

outputs.

- d. Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.
- e. All devices tested in walk test shall be recorded in the history buffer.

f. All devices not tested in walk test shall be recorded in the history buffer.

9. Waterflow Operation

An alarm from a waterflow detection device shall activate the appropriate alarm message on the control panel display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.

10. Supervisory Operation

An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a common supervisory LED, but will not cause the system to enter the trouble mode.

11. Signal Silence Operation

The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

12. Non-Alarm Input Operation

Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

## 1.9. SYSTEM COMPONENTS:

- A. Addressable Pull Box (manual station)
  - 1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
  - 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
  - 3. Manual pull stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- B. Intelligent Multi-Sensing Detector
  - 1. The intelligent detector shall be an addressable device which is capable of detecting multiple threats by employing photoelectric and thermal technologies in a single unit. This detector shall utilize advanced electronics which react to slow smoldering fires (photoelectric) and heat (thermal) all within a single sensing device.

- 2. The multi-detector shall include two bicolor LEDs for 360-degree viewing.
- 3. Automatically adjusts sensitivity levels without the need for operator intervention or programming. Sensitivity increases with heat.
- C. Intelligent Photoelectric Smoke Detector
  - 1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
  - 2. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
  - 3. Each detector shall contain a remote LED output and a built-in test switch.
  - 4. Detector shall be provided on a twist-lock base.
  - 5. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
  - 6. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
  - 7. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
  - 8. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
  - 9. All field wire connections shall be made to the base through the use of a clamping plate and screw.
- D. Projected Addressable Beam Detector
  - 1. The projected beam type shall be a 4-wire 24 VDC intelligent, addressable projected beam smoke detector device.
  - 2. The detector shall be listed to UL 268 and shall consist of a single transmitter/receiver and corresponding non powered reflector.
  - 3. The detector shall operate in either a short range (16' 230') or long range (16' 328') when used with an extender module.
  - 4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
  - 5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure proper alignment of unit without need of special tools.
  - 6. The unit shall be both ceiling and wall mountable.

- 7. The detector shall have the ability to be tested using calibrated test filters or magnet-activated remote test station.
- 8. The detector shall have four standard sensitivity selections along with two automatic self-adjusting settings. When either of the two automatic settings is selected the detector will automatically adjust its sensitivity using advanced software algorithms to select the optimum sensitivity for the specific environment.
- E. Intelligent Ionization Smoke Detector
  - 1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
- F. Intelligent Thermal Detectors
  - 1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
- G. Intelligent Duct Smoke Detector
  - 1. The smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
  - 2. 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.
- H. Addressable Dry Contact Monitor Module
  - 1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
  - 2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
  - 3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  - 4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
- I. Two-Wire Detector Monitoring
  - 1. Means shall be provided for the monitoring of conventional Initiating Device

Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).

- 2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
- 3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
- 4. The IDC zone may be wired for Style D or Style B (Class A or B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- 5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in an surface mount backbox.
- J. Addressable Control Relay Module
  - 1. Addressable control relay modules shall be provided to control the operation of fan shutdown and other auxiliary control functions.
  - 2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
  - 3. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.
  - 4. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
- K. Six Output Addressable Control Relay Module
  - 1. Up to 6 Addressable intelligent control relay modules combined on one circuit board shall be provided to control the operation of fan shutdown and other auxiliary control functions.
  - 2. Using rotary address switches, the first module shall be addressed from 01 to 94 while the remaining modules shall be automatically assigned to the next five higher addresses. Note, binary dip switches for setting address are not acceptable.
  - 3. Provision shall be included for disabling a maximum of three unused modules
  - 4. A single isolated set of dry relay form C contacts shall be provided for each of the 6 module addresses, which shall be capable of being wired for either a normally-open or normally-closed operation.

- 5. The module shall allow an addressable control panel to switch these contacts on command.
- 6. The module shall contain removable plug in terminal blocks capable of supporting 12 AWG to 18 AWG wire.
- 7. The control relays mounted on the module shall be suitable for pilot duty applications and rated for a maximum of 3.0 amps at 30 VDC, resistive, non-coded and 2.0 amps at 30 VDC maximum, resistive, coded.
- L. Six-Zone Interface Module
  - 1. A six zone interface module shall be provided as an interface between the addressable panel and two-wire conventional detection zones.
  - 2. A common SLC input shall be used for all modules, and the initiating device circuits shall share a common external supervisory supply and ground.
  - 3. The first address on the interface module shall be addressed from 01 to 94 while the remaining modules are automatically assigned to the next five higher addresses.
  - 4. Address shall be set using decimal encoded rotary address switches. Binary address switches are not acceptable.
  - 5. Provision shall be included for disabling a maximum of two unused addresses of the six available.
  - 6. All two-wire detectors being monitored shall be two-wire compatibility listed with the six zone input module.
  - 7. The six zone input module shall transmit the status of a zone of two-wire detectors to the fire alarm control panel. Status shall be reported as normal, open or alarm.
  - 8. Removable plug-in terminals shall be provided capable of accepting from 18 AWG up to 12 AWG wire.
- M. Multiple Two-Wire Detector Monitoring
  - 1. A single multi input module shall be provided for the monitoring of up to 10 conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally-open contact alarm initiating devices (pull stations, heat detectors, etc).
  - 2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable point. The module will supervise the IDC for alarms and circuit integrity (opens).
  - 3. The first address on the 10 input boards shall be set from 01 to 90 and the remaining module addresses shall be automatically assigned to the next nine higher addresses.

- 4. Provision shall be included for disabling a maximum of two unused addresses.
- 5. The supervised state (normal, open, or short) of the monitored device shall be sent back to the panel. A common SLC input shall be used for all modules, and the initiating device loops shall share a common supervisory supply and ground.
- 6. The IDC zone may be wired for Style D or Style B (Class A or B) operation. A green LED for each circuit shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. LEDs shall latch on when a circuit is in alarm.
- N. Isolator Module
  - Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Style 6 (Class A) or Style 4 (Class B branch). The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
  - 2. If a wire-to-wire short occurs, the isolator module shall automatically opencircuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
  - 3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
  - 4. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- O. ACS Serially Connected Annunciator
  - 1. The annunciator shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications circuit.
  - The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
    - a. Up to 32 annunciators, each with up to 64 points may be installed on the system.
    - b. The annunciator shall include a single electrical key switch to disable all switch functions.
    - c. The annunciator shall provide alarm and trouble resound, with flash for new conditions.
    - d. This unit shall provide for each zone: alarm indications, using a red alarm and

yellow trouble LEDs, and switches for the control of fire alarm control panel functions. The annunciator will also have an ON-LINE LED, local piezo electric signal, local acknowledge/lamp test switch, and custom slide-in zone/function identification labels.

- e. Switches shall be available for remote annunciation and control of output points in the system, system acknowledge, telephone zone select, speaker select, global signal silence, and global system reset within the confines of all applicable standards.
- 3. This system shall provide a means of interfacing to a graphic style annunciator.
- 4. The graphic annunciator interface will possess the capability of individually annunciating each individual addressable device in the system.
- P. Alphanumeric LCD Type Annunciator (terminal mode):
  - 1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
  - 2. The LCD annunciator shall display all alarm and trouble conditions in the system.
  - 3. An audible indication of alarm shall be integral to the alphanumeric display.
  - 4. The display shall be UL listed for fire alarm application.
  - 5. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
  - 6. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
- Q. Alphanumeric LCD Type Annunciator (Ann-Bus Mode):
  - 1. The alphanumeric display annunciator shall be a supervised, remotely located back-lit eighty (80) characters LCD display for alarm annunciation in clear English text.
  - 2. The LCD annunciator shall display all alarm and trouble conditions in the system.
  - 3. An audible indication of alarm shall be integral to the alphanumeric display.
  - 4. It shall be possible to connect up to 8 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
  - 5. Up to 8 total devices of any kind, LCD, printer gateway, LED, Relay or I/O module may be installed on the ANN-BUS.

## 1.10. SYSTEM COMPONENTS - ADDRESSABLE DEVICES

- A. Addressable Devices General
  - 1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
  - 2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
  - 3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.
  - 4. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 10.
  - 5. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
  - 6. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
  - 7. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
  - 8. Detectors shall provide address-setting means using decimal switches.

## 1.11. BATTERIES:

- A. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 or 60 hours) followed by 5 minutes of alarm.
- B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery/charger systems may be used.

#### PART 3.0 - EXECUTION

3.1. INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual pull stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

## 3.2. TEST:

The service of a competent, NICET level II technician shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 10.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all waterflow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short signaling line circuits and verify that the trouble signal actuates.
- F. Open and short notification appliance circuits and verify that trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check presence and audibility of tone at all alarm notification devices.
- I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
- J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

## 3.3. FINAL INSPECTION:

A. At the final inspection, a minimum NICET Level II technician shall demonstrate that the system functions properly in every respect.

# 3.4. INSTRUCTION:

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor or installing dealer shall provide a user manual indicating "Sequence of Operation."

END OF SECTION 283111

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Brick pavers set on compacted aggregate.
  - 2. Bedding and joint sand.
  - 3. Edge restraints.
  - 4. ADA compliant detectable warning pavers.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Pavers.
  - 2. Edge restraints.
  - 3. Test results for compliance with ASTM C936.
- B. Samples for Initial Selection: For the following:
  - 1. Color selection chart for each type of unit paver indicated.
  - 2. Edge restraints.
  - 3. Two full size samples of each paver type.
- C. Paver Installation Subcontractor; job references for 3 projects of similar size and complexity.

## 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Mockups: Build 5' x 10' mockup of each assembly to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Approved mockups may become part of the completed Work subject to Architect's approval.
  - 2. Do not proceed with paver work until Architect has inspected and approved the mock-up.

## 1.4 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquids in tightly closed containers protected from freezing.

## 1.5 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

# PART 2 - PRODUCTS

## 2.1 BRICK PAVERS

- A. Brick Pavers: Light traffic, solid clay paving bricks complying with ASTM C 902, Class SX, Type I, PS. Provide brick without frogs or cores in surfaces exposed to view.
  - 1. Thickness: 2-3/8 inches (60 mm).
  - 2. Face Size and Shape: 4 inch x 8 inches.
  - 3. Color: Match existing red brick at building.
  - 4. Edge: Chamfered.
  - 5. ADA Bricks: Same color, style and manufacturer as standard pavers.

## 2.2 ACCESSORIES

- A. Edge Restraints: L-shaped, 3/16" thick by (94 mm) wide by 1.7" (43-mm-) high 6063-T6, extruded aluminum with holes to receive stakes at 12 inches (300 mm) o.c.
  - 1. Basis of Design: "StructurEdge" by Permaloc.
  - 2. Spikes: 3/8" x 12" galvanized steel spikes.
  - 3. Finish: AAMA2603 black Duraflex.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

## 2.3 AGGREGATE MATERIALS

- A. Graded Aggregate for Subbase: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 57.
- B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33/C 33M for fine aggregate.
- C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 (1.18 mm) sieve and no more than 10 percent passing No. 200 (0.075-mm) sieve.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

#### 3.2 PREPARATION

A. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Proceed with subbase, setting bed and unit paver installation only after deficient subgrades have been corrected and are ready to receive base course for unit pavers.

#### 3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- D. Joint Pattern: As indicated.
- E. Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- F. Expansion and Control Joints: Provide joint filler at locations and of widths indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.

## 3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Place aggregate subbase, compact by tamping with plate vibrator, and screed to depth indicated.
- C. Place sand leveling course and screed to a thickness of 1-inch (25 mm), taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- D. Set pavers with a minimum joint width of 1/16 inch (1.5 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.

- E. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-Kn) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least four passes across paving with vibrator.
  - 1. Simultaneously spread, sweep and compact dry joint sand into joints between pavers.
  - 2. Add joint sand in areas where settling or erosion has occurred.
  - 3. Rework excess joint sand when project is complete.

## 3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are uneven, loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321400

SECTION 329113 - SOIL PREPARATION

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes planting soils and layered soil assemblies specified by composition of the mixes.
- B. Related Requirements:
  - 1. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
  - 2. Section 329300 "Plants" for placing planting soil for plantings.

#### 1.2 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include recommendations for application and use.
  - 2. Include test data substantiating that products comply with requirements.
  - 3. Include sieve analyses for aggregate materials.
  - 4. Material Certificates: For each type of soil amendment and fertilizer before delivery to the site, according to the following:
    - a. Manufacturer's qualified testing agency's certified analysis of standard products.
    - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

## 1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.
  - 1. Take soil samples from 3 locations as directed by Architect.
  - 2. Soil amendments shall be adjusted based on results of testing at no additional cost to the Owner.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:

- 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
- 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
- 3. Do not move or handle materials when they are wet or frozen.
- 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

## PART 2 - PRODUCTS

## 2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. Planting-Soil Type for Lawn: Existing, on-site surface soil; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
  - 1. Weight of Lime: two tons per acre.
  - 2. Weight of Slow-Release Fertilizer: 40 pounds per acre.
- B. Planting-Soil Type for tree, shrub and ground cover beds: Naturally formed topsoil from on-site or off-site sources, consisting of sandy loam, loam, silt loam or silty clay loam soil according to USDA textures; and modified to produce viable planting soil.
  - 1. Sources: Take imported, unamended topsoil from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep, not frombogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
  - 2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
  - 3. Unacceptable Properties: Remove the following from planting soil:
    - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    - b. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 3 inches (75 mm) in any dimension.
  - 4. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
    - a. Ratio of Loose Compost to Topsoil: 1:3 by volume.
    - b. Weight of Slow-Release Fertilizer: One pound per 1000 sq. ft. (100 sq. m) per 6 inches (150 mm) of soil depth.

# 2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: T, with a minimum of 99 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
  - 2. Form: Provide lime in form of ground calcitic limestone.
- B. Perlite: Horticultural perlite, soil amendment grade.
- C. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

#### 2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
  - 1. Feedstock: Lightly decomposed organic matter may not include sewage sludge.
  - 2. Reaction: pH of 5.0 to 7.5.
  - 3. Soluble-Salt Concentration: Less than 4 dS/m.
  - 4. Moisture Content: 35 to 55 percent by weight.
  - 5. Organic-Matter Content: 25 percent of dry weight.
  - 6. Particle Size: Minimum of 90 percent passing through a 1/2-inch (13-mm) sieve.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch (13-mm) sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.
- C. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

#### 2.4 FERTILIZERS

- A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
  - 2. Adjust composition per soil test recommendations.

## PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- B. Proceed with placement only after unsatisfactory conditions have been corrected.

## 3.2 TURF AND PLANTING AREA PREPARATION

- A. General: Uniformly grade areas to a smooth, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
  - 3. Locate and remove tree stumps and roots to a depth of 24 inches and sufficient to accommodate finish grading operations.
- B. Newly Graded Subgrades: Loosen Subgrade to a minimum depth of 2 inches (50 mm). Remove stones larger than 3 inches (75 mm) in any dimension and sticks, roots, rubbish, dead plants, construction debris, and other extraneous matter.
  - 1. If weeds or other undesirable plants have grown between completion of rough grading and commencement of finish grading, apply herbicide in affected area directly on weeds, and limited only to areas where needed.
  - 2. Ensure that subgrade is properly sloped to prevent standing water in planted areas and to provide positive drainage away from walks, roads, and buildings. Regrade if necessary.
  - 3. Apply soil amendments per recommendations of Preconstruction Testing Service.
  - 4. Cultivate using a tine harrow, chain-disk harrow or other suitable equipment to break up lumps of soil and provide a smooth, level soil surface ready for planting. Finish graded surface shall be deemed sufficient, if after planting and growth of lawn, the area is level enough to be conveniently mowed by use of a walk-behind mower.

## 3.3 PLACING AND MIXING PLANTING SOIL IN TREE, SHRUB AND GROUND COVER BEDS

- A. General: Apply and mix unamended topsoil with compost and other amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet. Remove duff layer in all planting beds.
- B. Subgrade Preparation: Till remaining topsoil to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter.
- C. Mixing: Spread unamended soil to total depth of 4 inches (100 mm), but not less than required to meet finish grades after mixing with amendments and natural settlement.

- 1. Amendments: Apply soil amendments, compost, and fertilizer, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
  - a. Mix fertilizer with planting soil no more than seven days before planting.
- 2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches (200 mm) in loose depth for material compacted by compaction equipment, and not more than 6 inches (150 mm) in loose depth for material compacted by hand-operated tampers.
- D. Compaction: Compact each blended lift of planting soil to 85 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

## 3.4 BLENDING PLANTING SOIL IN PLACE FOR LAWN AREAS

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Mixing: Apply lime and fertilizer, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.
  - 1. Mix lime with dry soil before mixing fertilizer.
  - 2. Mix fertilizer with planting soil no more than seven days before planting.
- C. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

## 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Soil will be considered defective if it does not pass tests and inspections.

## 3.6 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Vehicle traffic.
  - 4. Foot traffic.
  - 5. Erection of sheds or structures.
  - 6. Impoundment of water.
- 7. Excavation or other digging unless otherwise indicated.
- C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

# 3.7 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Dispose of excess subsoil and unsuitable materials off-site.

END OF SECTION 329113

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Seeding.
  - 2. Sodding.
  - 3. Turf renovation.

#### 1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For soil amendments and fertilizers, from manufacturer.

# 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.
- C. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

# 1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

# 1.6 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
  - 2. Warranty Periods from Date of Substantial Completion:
    - a. 12 months minimum but not less than one full growing season.

- 3. Include the following remedial actions as a minimum:
  - a. Immediately remove dead turf and replace unless required to plant in the succeeding planting season.
  - b. Provide extended warranty for period equal to original warranty period, for replaced lawn material.

# PART 2 - PRODUCTS

# 2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species:
  - 1. Quality, State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed.
  - 2. Full Sun, Cool-Season Grass: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
  - 3. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:
    - a. 50 percent Kentucky bluegrass (Poa pratensis).
    - b. 30 percent chewings red fescue (Festuca rubra variety).
    - c. 10 percent perennial ryegrass (Lolium perenne).
    - d. 10 percent redtop (Agrostis alba).
  - 4. Shade, Cool-Season Grass: Proportioned by weight as follows:
    - a. 50 percent chewings red fescue (Festuca rubra variety).
    - b. 35 percent rough bluegrass (Poa trivialis).
    - c. 15 percent redtop (Agrostic alba).

# 2.2 TURFGRASS SOD

- A. Turfgrass Sod: Approved, Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows:
  - 1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
  - 2. Sun and Partial Shade: Proportioned by weight as follows:
    - a. 50 percent Kentucky bluegrass (Poa pratensis).

- b. 30 percent chewings red fescue (Festuca rubra variety).
- c. 10 percent perennial ryegrass (Lolium perenne).
- d. 10 percent redtop (Agrostis alba).
- 3. Shade: Proportioned by weight as follows:
  - a. 50 percent chewings red fescue (Festuca rubra variety).
  - b. 35 percent rough bluegrass (Poa trivialis).
  - c. 15 percent redtop (Agrostis alba).

# 2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm), 3/4inch (19-mm), 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  - 1. Organic Matter Content: 60 percent of dry weight.
  - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or sourceseparated or compostable mixed solid waste.

# 2.4 FERTILIZERS

- A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: Nitrogen, phosphorous, and potassium in percentages recommended in report from a qualified soil-testing laboratory.

# 2.5 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

# 2.6 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

# 2.7 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Apply herbicide for weed control only where undesirable plants or roots remain after grading. Remove dead plant material and roots by raking and cultivating the soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination and replace with new planting soil.

# 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, grade stakes and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

# 3.3 TURF AREA PREPARATION

A. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

- 1. Ensure grades are sloped to provide positive drainage away from buildings, walkways, pavements and toward drainage structures such that no standing water occurs on paved or lawn areas.
- 2. Do not install sod until finish grades are properly sloped for drainage.
- B. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- D. Ensure that rough grade is established at elevation such that depth of sod is accommodated.
  - 1. Unless indicated otherwise, finish grade with sod installed shall be one inch below adjacent pavement.
  - 2. If sod is installed too high and water is dammed on pavements, remove sod, regrade and install replacement sod.

# 3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Measure slopes and mark areas requiring erosion control materials. Include areas that exceed slopes requiring mesh or blankets, whether or not indicated on plans.
- B. Prepare area as specified in "Turf Area Preparation" Article.
- C. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- D. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

# 3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
  - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft. (2.3 to 3.6 kg/92.9 sq. m).
- C. Rake seed lightly into top 1/8 inch (3 mm) of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre (42 kg/92.9 sq. m) to form a continuous blanket 1-1/2

inches (38 mm) in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

- 1. Install erosion control blankets or fiber mesh in areas with slopes not exceeding 1:6 wherever other factors such as concentrated water flows or construction activity are causing erosion.
- 2. Anchor straw mulch by crimping.
- 3. Replace or re-crimp mulch that is displaced by wind and remove accumulations of displaced mulch on site and on adjacent property.
- F. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch (4.8 mm), and roll surface smooth.

# 3.6 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  - 1. Lay sod across angle of slopes exceeding 1:3.
  - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

# 3.7 TURF RENOVATION

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  - 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.

- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.
- I. Apply seed and mulch.
- J. Water newly seeded areas and keep moist until new turf is established.

# 3.8 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling, erosion or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  - 2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain 2" grass height.
- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
  - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) to turf area.

#### 3.9 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
  - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, evencolored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

# 3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

#### 3.11 CLEANUP AND PROTECTION

- A. Remove and reinstall seed and mulch that are displaced before seed germinates and lawn is established.
- B. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass is established.
- E. Remove mulch netting after grass is established and before first mowing.

#### 3.12 MAINTENANCE SERVICES

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
  - 1. Sodded and Seeded Turf: 30 days from date of Substantial Completion or the date of completion of the landscape work, whichever is later.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Plants.
  - 2. Landscape edgings.
- B. Related Sections:
  - 1. Section 329200 "Turf and Grasses".
  - 2. Section 329113 "Soil Preparation".

#### 1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a wellestablished root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown inground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- H. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

- I. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- J. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
  - 2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
- B. Samples for Verification: For each of the following:
  - 1. Trees and Shrubs: Three samples of each variety and size delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
  - 2. Organic Mulch: 1-quart (1-liter) volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
  - 3. Mineral Mulch: 2 lb (1.0 kg), 5 lb (2.5 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
  - 4. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
  - 5. Edging Materials and Accessories: 2'-0" long with fasteners.
  - 6. Root Barrier: Width of panel by 12 inches (300 mm).
- C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- E. Warranty: Special warranty, 2 copies.

# 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
  - 1. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
  - 2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 3. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
  - 1. Notify Architect of sources of planting materials seven days in advance of delivery to site.
- E. Preinstallation Conference: Conduct conference at Project site.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
- C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

- 1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
- 2. Set balled stock on ground and cover ball with soil, peat moss or sawdust.
- 3. Do not remove container-grown stock from containers before time of planting.
- 4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.
  - 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas.

# 1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
    - b. Structural failures including plantings falling or blowing over.
    - c. Faulty performance of edgings.
    - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Periods from Date of Planting Completion:
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months, minimum, but not less than 1 full growing season.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months, minimum, but not less than 1 full growing season.

- 3. Include the following remedial actions as a minimum:
  - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
  - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
  - c. Provide extended warranty for period equal to original warranty period, for replaced plant material.

# PART 2 - PRODUCTS

# 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk; crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots will be rejected.
  - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.
- E. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

# 2.2 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

- 1. Type: Shredded hardwood, Ground or shredded bark, Pine straw, Pine needles, Peanut, pecan, and cocoa-bean shells organic compost.
- 2. Size Range: 2 inches maximum.
- 3. Color: As selected by Architect from manufacturer's full range of color options.

# 2.3 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

# 2.4 LANDSCAPE EDGINGS

- A. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
  - 1. Edging Size: 1/4 inch wide by 5 inches deep.
  - 2. Stakes: Tapered steel, a minimum of 12 inches (300 mm) long.
  - 3. Accessories: Standard tapered ends, corners, and splicers.
  - 4. Finish: Standard paint.
  - 5. Paint Color: Black.

# 2.5 MISCELLANEOUS PRODUCTS

- A. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils (2.2 mm) thick, with vertical root deflecting ribs protruding 3/4 inch (19 mm) out from panel, and each panel 24 inches (610 mm) deep.
- B. Tree Stabilization Materials:
  - 1. Guy Stakes: Rough-sawn, sound, new hardwood, 2 by 2 inch nominal (38 by 38 mm actual) by length indicated, pointed at one end.
  - 2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes or compression springs.
  - 3. Guys and tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch (92.7 mm) in diameter.
  - 4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
  - 5. Guy Cables: Five-strand, 3/16 inch (4.8 mm) diameter, galvanized steel cable, with zinc coated turnbuckles, a minimum of 3 inches (75 mm) long, with two 3/8 inch (10 mm) galvanized eyebolts.
  - 6. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

# 2.6 TREE PROTECTORS

- A. Staked tree protectors: Rigid single-wall slit tube, ventilated, with flared top to protect tree from sharp edges.
  - 1. Material: Recycled polyethylene, UV stabilized.
  - 2. Size: 4-1/4 inch diameter, height as required for tree size.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain optimum results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination and replace with new planting soil.

#### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

# 3.3 PLANTING AREA ESTABLISHMENT

- A. Mark the ground where trees and planting beds will be located, following locations indicated on landscape drawing as closely as possible. Before commencing excavations, notify Architect for approval of plant locations.
  - 1. Architect may change plant locations in the field.
  - 2. Do not commence excavations without Architect's approval.
- B. Loosen subgrade of planting areas to a minimum depth of 6 inches (150 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  - 1. Excavate and backfill with planting soil to the following minimum depths:
    - a. Trees and Shrubs: 2'-0" or depth of roof ball plus six inches.
    - b. Shrub Beds: 1'-6" or depth of roof ball plus six inches.
    - c. Peremial and ground cover beds: 6".

- 2. Spread planting soil to a depth not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet. Ensure that planting soil is properly mixed before installing plants in bed. If planting soil is not properly mixed, remove installed plants, introduce compost, fertilizer and other required amendments and thoroughly mix with topsoil in place before reinstalling plants
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

# 3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 60degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped, balled and potted, container-grown, fabric bag-grown stock.
  - 2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
  - 4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
  - 5. Maintain supervision of excavations during working hours.
  - 6. Keep excavations covered or otherwise protected overnight, after working hours and when unattended by Installer's personnel.
- B. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

# 3.5 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
  - 1. Use planting soil for backfill.
  - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops and sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Set container-grown and fabric bag grown stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
  - 1. Use planting soil for backfill.
  - 2. Carefully remove root ball from container without damaging root ball or plant.
  - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Set and support bare-root stock in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grade.
  - 1. Use planting soil for backfill.
  - 2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
  - 3. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

# 3.6 ROOT-BARRIER INSTALLATION

- A. Install root barrier where trees are planted within 48 inches (1200 mm) of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings.
- B. Align root barrier with bottom edge angled at 20 degrees away from the paving or other hardscape element and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of 60 inches (1500 mm) in each direction from the tree trunk, for a total distance of 10 feet (3 m) per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  - 1. Position top of root barrier flush with finish grade.
  - 2. Do not distort or bend root barrier during construction activities.
  - 3. Do not install root barrier surrounding the root ball of tree.

# 3.7 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.
- B. Plant in bedded areas backfilled with planting soil throughout the planting bed.
- C. Dig holes large enough to allow spreading of roots. Carefully loosen bundles of knotted roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

#### 3.8 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching in locations indicated. Completely cover area to be mulched, overlapping edges a minimum of 12 inches (300mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with 36-inch (900-mm) radius around trunks or stems. Do not place mulch within 6 inches (150 mm) of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 2-inch (50-mm) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches (150 mm) of trunks or stems.
  - 3. Mineral Mulch in Planting Areas: Apply 2-inch (50-mm) average thickness of mineral mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches (150 mm) of trunks or stems.

# 3.9 EDGING INSTALLATION

- A. Steel Edging: Install steel edging where indicated. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging. Recess edging into soil so that no more than one inch is exposed on low side.
- B. Shovel-Cut Edging: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch-(100- to 150-mm-) deep, shovel-cut edge.

#### 3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

# 3.11 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and the work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion, remove nursery tags, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

#### 3.12 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property

#### 3.13 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees, Groundcovers and Shrubs: Provide maintenance by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
  - 1. Maintenance Period: 30 days from date of Substantial Completion, or the date of completion of the landscape work, whichever is later.

END OF SECTION 329300