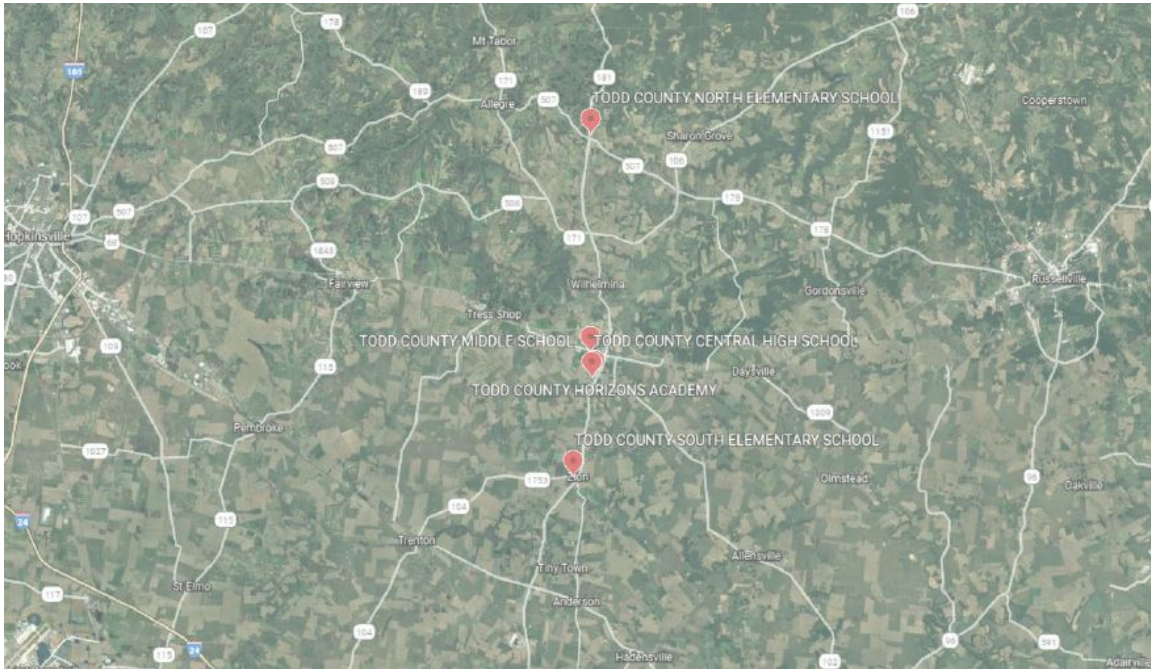


**PROJECT MANUAL FOR**  
Todd County Schools Upgrade Projects  
Todd County, Kentucky



**OWNER**

Todd County Board of Education  
Attn: Superintendent Mark Thomas  
205 Airport Road  
Elkton, Kentucky 42220

**ARCHITECT**

Deco Architects, Inc.  
Attn: Mr. Derek Phillips  
127 Old Monticello Street, Suite 1  
Somerset, Kentucky 42501

**MEP ENGINEER**

Sky Engineering  
Attn: Mr. Nami Nahid  
1830 Destiny Lane, Suite 113  
Bowling Green, Kentucky 42104

**LANDSCAPE/SITE**

**SITE**

Attn: Mr. John Sewell  
159 4th Avenue North, Suite 100  
Nashville, Tennessee 37219

**CONTRACTOR SIGN-IN SHEET**

	<b>Name</b>	<b>Phone</b>	<b>E-mail</b>
<b>1.</b>			
<b>2.</b>			
<b>3.</b>			
<b>4.</b>			
<b>5.</b>			
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<b>12.</b>			
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<b>14.</b>			
<b>15.</b>			

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**SECTION 000100**

**INVITATION TO BID**

NORTH TODD ELEMENTARY, SOUTH TODD ELEMENTARY, TODD CO HORIZONS ACADEMY UPGRADES  
Todd County, Kentucky

The Todd County Board of Education will receive sealed bids for the North Todd Elementary Upgrades (BG #21-063), South Todd Elementary Upgrades (BG #21-064), and Todd County Horizons Academy Safety Upgrades (BG #21-060). These projects are located in Todd County, Kentucky. Bids will be received at the Todd County Board of Education, 205 Airport Road, Elkton, Kentucky 42220, where bids will be publicly opened and read aloud.

**All bids must be received on or before 2:00 PM (local time) Tuesday, March 23, 2021.**

Copies of plans and specifications may be obtained via e-mail from SKY Engineering. Please contact 270-599-0182 and request PDF drawings and specifications.

The Form of Proposal must be requested from the Engineer, SKY Engineering, 1830 Destiny Lane, #113, Bowling Green, KY 42104 (phone 270-599-0182). All bids shall be submitted only on the Form of Proposal and in a sealed envelope. The sealed envelope shall have the Project Name clearly marked, along with the respected bidder's information.

SKY Engineering is the Engineer of Record for this project, acting as agent for the Owner and acting in the Owner's behalf in soliciting your proposal. Successful Bidder will have a Contract directly with the Owner.

Each Proposal shall be accompanied by a certified check, cash, or bidders bond, executed by the Bidder and Surety Company, IN THE SUM OF NOT LESS THAN FIVE PERCENT (5%) OF THE AMOUNT OF THE BASE PROPOSAL. The bid security is required as a guarantee that if the Proposal is accepted, a Contract will be immediately entered into and the performance of it properly secured.

Proposal Forms must be properly filled out and submitted in duplicate. No qualify letters or statements will be considered. No bidder may withdraw a bid submitted for a period of sixty (60) days after the date for the opening of the Bid.

In the event the Bidder to whom the Contract is awarded fails to execute a satisfactory Contract and 100% Performance and Payment Bond, they shall be eliminated and shall forfeit their certified check, cash, or their Bid Bond and shall be liable for the loss incurred by the Owner by such failure.

Any Bid which is not received on a timely basis of in the proper form shall be returned unopened.

**A pre-bid conference will be held at the Todd County Board of Education (205 Airport Road), Tuesday, March 9, 2021 at 10:00 a.m. local time.**

**SECTION 000100**

**INVITATION TO BID**

**TODD COUNTY MIDDLE SCHOOL & TODD COUNTY CENTRAL HIGH SCHOOL + ANNEX UPGRADES  
Todd County, Kentucky**

The Todd County Board of Education will receive sealed bids for the Todd County Middle School Upgrades (BG #21-061) and Todd County Central High School + Annex Upgrades (BG #21-062), located in Elkton, Kentucky. Bids will be received at the Todd County Board of Education, 205 Airport Road, Elkton, Kentucky 42220, where bids will be publicly opened and read aloud.

**All bids must be received on or before 2:00 PM (local time) Tuesday, March 23, 2021.**

Copies of plans and specifications may be obtained via e-mail from SKY Engineering. Please contact 270-599-0182 and request PDF drawings and specifications.

The Form of Proposal must be requested from the Engineer, SKY Engineering, 1830 Destiny Lane, #113, Bowling Green, KY 42104 (phone 270-599-0182). All bids shall be submitted only on the Form of Proposal and in a sealed envelope. The sealed envelope shall have the Project Name clearly marked, along with the respected bidder's information.

SKY Engineering is the Engineer of Record for this project, acting as agent for the Owner and acting in the Owner's behalf in soliciting your proposal. Successful Bidder will have a Contract directly with the Owner.

Each Proposal shall be accompanied by a certified check, cash, or bidders bond, executed by the Bidder and Surety Company, IN THE SUM OF NOT LESS THAN FIVE PERCENT (5%) OF THE AMOUNT OF THE BASE PROPOSAL. The bid security is required as a guarantee that if the Proposal is accepted, a Contract will be immediately entered into and the performance of it properly secured.

Proposal Forms must be properly filled out and submitted in duplicate. No qualify letters or statements will be considered. No bidder may withdraw a bid submitted for a period of sixty (60) days after the date for the opening of the Bid.

In the event the Bidder to whom the Contract is awarded fails to execute a satisfactory Contract and 100% Performance and Payment Bond, they shall be eliminated and shall forfeit their certified check, cash, or their Bid Bond and shall be liable for the loss incurred by the Owner by such failure.

Any Bid which is not received on a timely basis of in the proper form shall be returned unopened.

**A pre-bid conference will be held at the Todd County Board of Education (205 Airport Road), Tuesday, March 9, 2021 at 10:00 a.m. local time.**

**(End of Section 000100)**

# Kentucky Department of Education Version of AIA<sup>®</sup> Document A701<sup>™</sup> – 1997

## *Instructions to Bidders*



This version of AIA Document A701<sup>™</sup>–1997 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A701–1997 does not imply the American Institute of Architects’ endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A701–1997 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 A701<sup>™</sup>– 1997, Instructions to Bidders — KDE Version,” or “AIA Document A701<sup>™</sup>–1997 — KDE Version.”

# Kentucky Department of Education Version of AIA® Document A701™ – 1997

## *Instructions to Bidders*

for the following PROJECT:  
*(Name and location or address)*

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

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

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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™, 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)



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

§ 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™, 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™, 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

§ 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 stationery 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.

**§ 6.6.2** For Projects with Bid Division: General Construction and Concrete, Masonry, Plumbing, HVAC and Electrical Contractors shall 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 Purchase Orders direct to the suppliers for these materials. The following shall be provided:

- .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™-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™–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™–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 resubmittal 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 001010**

### **SUPPLEMENTARY INSTRUCTIONS TO BIDDERS**

#### **TODD COUNTY SCHOOLS UPGRADE PROJECTS Todd County, Kentucky**

The following Supplementary Instructions to Bidders modify or add to the AIA Document A701-1997 Instructions to Bidders and KDE Amendment AIA 701-1987 of Division of Building and Grounds, Kentucky Department of Education, copies of which are bound into the Project Specifications. Where any article of the Instructions is modified or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these supplements, the unaltered, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

### **ARTICLE 3 BIDDING DOCUMENTS**

#### **3.2 INTERPRETATION OF BIDDING DOCUMENTS**

##### **Add the following subparagraphs:**

##### **3.2.4 WORK REASONABLE INFERRED, BUT NOT PARTICULARLY DELINEATED OR SPECIFIED:**

The Contractor shall study all drawings and specifications and all conditions relating to the erection of the work, and if any material 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 reasonable inferred therefrom, unless eliminated by special mention, or if any error or inconsistency appear therein, or in the event of a doubt arising as to the true intent and meaning of the drawings or specification, they shall report it to the Engineer at least ten (10) days in advance of the date for receiving the bid. The Engineer will then issue an addendum containing the proper information to all Contractors to assure fair competition.

In case the contractor fails to make such report and the Engineer is not otherwise advised of such doubtful matter, the Contractor is hereby made responsible for the furnishing of the necessary labor and material reasonable inferred or evidently necessary for the proper execution and completion of the work; for any additional work involved in the correction of apparent errors of inconsistencies by the Engineer, and all such labor and materials shall be provided at the Contractor's expenses and under no condition will any such labor and material be allowed as an extra.

##### **3.2.5 DISCREPANCIES:**

Anything called for in specifications and not shown on the drawings or shown on the drawings and not called for in the specification shall be included in both. Where the detail and general drawings do not agree, the Contractor shall notify the Engineer at least ten (10) days before the date of the receipt of bids, and the Engineer will issue an Addendum to all Contractors as to which of the two methods of constructions shall be followed. Failure to make this determination shall make the Contractor subject to furnishing either method of, as may be later called for by



the Engineer. In case of discrepancies between the various parts of the plans and specifications, the Contractor shall furnish either method as may be determined by the Engineer.

### **3.3 SUBSTITUTIONS**

Add the following paragraph to the front end of 3.4.3:

3.4.3 Examine bidding documents carefully prior to date for receipt of bids, make written request to Engineer for true meaning of any part of contract documents, for interpretation and correction of any ambiguity, inconsistency, or therein. All interpretations and corrections will be included in an addendum issued by Engineer. Contractor's written questions can be sent by photo facsimile to the Engineer for interpretation. Only a written interpretation or correction by addendum shall be binding. No Bidder shall reply upon interpretation or corrections given by any other method.

## **ARTICLE 5 CONSIDERATION OF BIDS**

### **5.3 ACCEPTANCE OF BID (AWARD)**

Add the following subparagraph:

5.3.4 Time limit for Execution of Contract Documents: In the event that a bidder's proposal is accepted by the Owner and such bidder shall fail to execute the contract and to furnish satisfactory performance bond within ten (10) calendar days from the date of notification of the award of contract, the Owner may at its option, determine that the awardee has abandoned the contract. Thereupon, the proposal shall become null and void and guarantee, which accompanied it, shall be forfeited to and become all property of the Owner as liquidated damages from such failure. If the bidder shall execute the contract and furnish satisfactory bond, the bid guarantee will be returned to the bidder by the Owner.

## **ARTICLE 6 POST-BID INFORMATION**

### **6.1 CONTRACTORS QUALIFICATION STATEMENT**

Add the following subparagraph:

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

## **ARTICLE 12 POST BID REVIEW AND MATERIAL SUBMITTAL**

12.1.1. Prime Bidders; change the words "Prime Bidders" to "Mechanical and Electrical Contractor Bid Packages."

**(End of Section 001010)**

**SECTION 051005**

**BIDDING PACKAGES + ALTERNATES**

**TODD COUNTY SCHOOLS UPGRADE PROJECTS**  
Todd County, Kentucky

Todd County Schools will be bid in 2 different packages, however due to each project having own project documents, all five bid documents must be completed if the bidding General Contractor is looking to win the individual packages. Alternates must be filled for each project where GC is bidding for.

**Bid Package #1:**

This bid package includes combination of **North Todd Elementary School, South Todd Elementary School, and Todd County Horizons Academy.**

Bidding Contractor must fill in all individual bids for these schools; however total of these schools will determine the winning contractor as the work will be under one GC. All alternates will also need to be filled for each school.

**Bid Package #2:**

This bid package includes combination of **Todd County Central High School + Annex and Todd County Middle School.**

Bidding Contractor must fill in all individual bids for these schools; however total of these schools will determine the winning contractor as the work will be under one GC. All alternates will also need to be filled for each school.

**Alternates:**

**Alternate #1:**

This alternate is to include technology package by BCS. If this package is included within the bid amount, then insert \$0 for this alternate.

**Alternate #2:**

This alternate is to include the Verkada Camera package as the manufacturer of all cameras installed within this bid package. If this package is included within the bid amount, then insert \$0 for this alternate.

**Alternate #3:**

This alternate is to install Reliable HVAC Control system installed by ABC. If this control is part of the base bid, then insert \$0 for this alternate.

**Alternate #4:**

This alternate is to select Daikin HVAC equipment. If this control is part of the base bid, then insert \$0 for this alternate.

BG No. \_\_\_\_\_

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

To: \_\_\_\_\_ (Owner)

Project Name: \_\_\_\_\_ Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BID PACKAGE #1:**

**North Todd Elementary School, South Todd Elementary School, and Todd County Horizons Academy.**

Also fill in individual school's Form of Proposal Bid Package following this document, due to project KDE allocation funds. Individual school's bid packages must add up to this combination package amount.

BASE BID: For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_ Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

ALTERNATE BIDS: (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	<b>BCS Technology Pack</b>			
Alt. Bid No. 2	<b>Verkada Camera</b>			
Alt. Bid No. 3	<b>Reliable Control</b>			


**BID PACKAGE #2:**

**Todd County Central High School + Annex and Todd County Middle School.**

Also fill in individual school's Form of Proposal Bid Package following this document, due to project KDE allocation funds. Individual school's bid packages must add up to this combination package amount.

BASE BID: For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_

Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

ALTERNATE BIDS: (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

<b>Alternate Bid No.</b>	<b>Alternate Description</b>	<b>+ (Add to the Base Bid)</b>	<b>- (Deduct from the Base Bid)</b>	<b>No Cost Change (from the Base Bid)</b>
Alt. Bid No. 1	<b>BCS Technology Pack</b>			
Alt. Bid No. 2	<b>Verkada Camera</b>			
Alt. Bid No. 3	<b>Reliable Control</b>			
Alt. Bid No. 4	<b>Daikin HVAC System</b>			

**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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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**BID PACKAGE #1:**

**North Todd Elementary School, South Todd Elementary School, and Todd County Horizons Academy.**

**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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	“Thermostat” Control System, Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Fault Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4”) EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	Flush Wood Door		Per Each, Per Spec. Sec. 08 14 16
11.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec. Sec. 08 14 16
12.	Flush Hollow Metal Door		Per Each, Per Spec. Sec. 08 11 13
13.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec. Sec. 08 11 13
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**BID PACKAGE #2:**

**Todd County Central High School + Annex and Todd County Middle School.**

**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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System, Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Fault Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	1/2 Inch Copper Piping, Installed		Per Linear Foot
11.	1 Inch Copper Piping, Installed		Per Linear Foot
12.	Single Pole Light Switch w/ Conduit & Wiring		Per Each
13.	3-Way Light Switch w/ Conduit & Wiring		Per Each
14.	#8 Type THHN Conductor		Per Linear Foot
15.	2x4 Flat Panel Light, Installed		Per Each
16.	VRF Cassette Added, Installed		Per Each
17.	High Bay Light Fixture, Installed		Per Each
18.	Flush Wood Door		Per Each, Per Spec. Sec. 08 14 16

19.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec. Sec. 08 14 16
20.	Flush Hollow Metal Door		Per Each, Per Spec. Sec. 08 11 13
21.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec. Sec. 08 11 13

**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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (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 NAME: \_\_\_\_\_ REPRESENTATIVE'S  
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.~~ \$100,000. (change effective June 3, 2019.)**

**This form shall not be modified.**

BG No. 21-060

Date: \_\_\_\_\_ To: \_\_\_\_\_ (Owner)

Project Name: Todd County Horizons Academy Safety Upgrades Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BASE BID:** For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_ Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

**ALTERNATE BIDS:** (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	Base Tech. Pkg. by BCS			
Alt. Bid No. 2	Verkada Camera Pkg.			
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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<p><b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)</p>	<p><b><u>SUPPLIER</u></b> (to be filled out by the Contractor)</p>	<p><b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)</p>
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Fault Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	Flush Wood Door		Per Each, Per Spec Sec. 08 14 16
11.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec Sec. 08 14 16
12.	Flush Hollow Metal Door		Per Each, Per Spec Sec. 08 11 13
13.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec Sec. 08 11 13
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	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
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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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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**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  
NAME: \_\_\_\_\_  
Signature

REPRESENTATIVE'S

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.~~ \$100,000. (change effective June 3, 2019.)***

**This form shall not be modified.**

BG No. 21-061

Date: \_\_\_\_\_ To: \_\_\_\_\_ (Owner)

Project Name: Todd County Middle School Upgrades Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BASE BID:** For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents  
Use Figures

Use Words for both dollars and cents

**ALTERNATE BIDS:** (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	Daiken HVAC Equipment			
Alt. Bid No. 2	Reliable HVAC Controls by "ABC"			
Alt. Bid No. 3	Base Tech. Pkg. by "BCS"			
Alt. Bid No. 4	Verkada Camera Pkg.			
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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<p><b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)</p>	<p><b><u>SUPPLIER</u></b> (to be filled out by the Contractor)</p>	<p><b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)</p>
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Faut Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	1/2 Inch Copper Piping, Installed		Per Linear Foot
11.	1 inch Copper Piping, Installed		Per Linear Foot
12.	Single Pole Light Switch w/ Conduit & Wiring		Per Each
13.	3-Way Light Switch w/ Conduit & Wiring		Per Each
14.	#8 Type THHN Conductor		Per Linear Foot
15.	2x4 Flat Panel Light, Installed		Per Each
16.	Flush Wood Door		Per Each, Per Spec Sec. 08 14 16
17.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec Sec. 08 14 16
18.	Flush Hollow Metal Door		Per Each, Per Spec Sec. 08 11 13
19.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec Sec. 08 11 13

	<u>WORK</u> (to be filled out by the Architect)	<u>PRICE / UNIT</u> (to be filled out by the Contractor)	<u>UNIT</u> (to be filled out by the Contractor)
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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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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**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  
NAME: \_\_\_\_\_  
Signature

REPRESENTATIVE'S

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.~~ \$100,000. (change effective June 3, 2019.)**

**This form shall not be modified.**

BG No. 21-062

Date: \_\_\_\_\_ To: \_\_\_\_\_ (Owner)

Project Name: Todd County Central High School + Annex Upgrades Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BASE BID:** For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_

Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

**ALTERNATE BIDS:** (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	Daiken HVAC Equipment			
Alt. Bid No. 2	Reliable HVAC Controls by "ABC"			
Alt. Bid No. 3	Base Tech. Pkg. by "BCS"			
Alt. Bid No. 4	Verkada Camera Pkg.			
Alt. Bid No. 5				
Alt. Bid No. 6				
Alt. Bid No. 7				
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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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Faut Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	1/2 Inch Copper Piping, Installed		Per Linear Foot
11.	1 inch Copper Piping, Installed		Per Linear Foot
12.	Single Pole Light Switch w/ Conduit & Wiring		Per Each
13.	3-Way Light Switch w/ Conduit & Wiring		Per Each
14.	#8 Type THHN Conductor		Per Linear Foot
15.	2x4 Flat Panel Light, Installed		Per Each
16.	VRF Casette Added, Installed		Per Each
17.	High Bay Light Fixture, Installed		Per Each
18.	Flush Wood Door		Per Each, Per Spec Sec 08 14 16
19.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec Sec 08 14 16

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
20.	Flush Hollow Metal Door		Per Each, Per Spec Sec. 08 11 13
21.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec Sec. 08 11 13
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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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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**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  
NAME: \_\_\_\_\_  
Signature

REPRESENTATIVE'S

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.~~ \$100,000. (change effective June 3, 2019.)***

**This form shall not be modified.**

BG No. 21-063

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

To: \_\_\_\_\_ (Owner)

Project Name: North Todd Elementary School Upgrades Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_

\_\_\_\_\_ Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BASE BID:** For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_

Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

**ALTERNATE BIDS:** (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	Reliable HVAC Controls by "ABC"			
Alt. Bid No. 2	Base Tech. Pkg. by BCS			
Alt. Bid No. 3	Verkada Camera Pkg.			
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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<p><b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)</p>	<p><b><u>SUPPLIER</u></b> (to be filled out by the Contractor)</p>	<p><b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)</p>
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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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.**

	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Faut Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	Flush Wood Door		Per Each, Per Spec Sec. 08 14 16
11.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec Sec. 08 14 16
12.	Flush Hollow Metal Door		Per Each, Per Spec Sec. 08 11 13
13.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec Sec. 08 11 13
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	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
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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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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**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  
NAME: \_\_\_\_\_  
Signature

REPRESENTATIVE'S

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.~~ \$100,000. (change effective June 3, 2019.)***

**This form shall not be modified.**

BG No. 21-064

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

To: \_\_\_\_\_ (Owner)

Project Name: South Todd Elementary School Upgrades Bid Package No. \_\_\_\_\_

City, County: \_\_\_\_\_

Name of Contractor: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Business \_\_\_\_\_ Address: \_\_\_\_\_

\_\_\_\_\_ Telephone: \_\_\_\_\_

Having carefully examined the Instructions to Bidders, Contract Agreement, General Conditions, Supplemental Conditions, Specifications, and Drawings, for the above referenced project, the undersigned bidder proposes to furnish all labor, materials, equipment, tools, supplies, and temporary devices required to complete the work in accordance with the contract documents and any addenda listed below for the price stated herein.

Addendum \_\_\_\_\_ (Insert the addendum numbers received or the word "none" if no addendum received.)

**BASE BID:** For the construction required to complete the work, in accordance with the contract documents, I/We submit the following lump sum price of:

\_\_\_\_\_ Use Figures

\_\_\_\_\_ Dollars & \_\_\_\_\_ Cents

Use Words for both dollars and cents

**ALTERNATE BIDS:** (If applicable and denoted in the Bidding Documents)

For omission from or addition to those items, services, or construction specified in Bidding Documents by alternate number, the following lump sum price will be added or deducted from the base bid.

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	Reliable HVAC Controls by "ABC"			
Alt. Bid No. 2	Base Tech. Pkg. by BCS			
Alt. Bid No. 3	Verkada Camera Pkg.			
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.**

	<b><u>BRANCH OF WORK</u></b> (to be filled out by the Architect)	<b><u>SUBCONTRACTOR</u></b> (to be filled out by the contractor)
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	<b>BRANCH OF WORK</b> (to be filled out by the Architect)	<b>SUBCONTRACTOR</b> (to be filled out by the Contractor)
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**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.**

	<b><u>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</u></b> (to be filled out by the Architect or Contractor)	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>MANUFACTURER</u></b> (to be filled out by the Contractor)
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	<u><b>MATERIAL DESCRIPTION BY SPECIFICATION DIVISION AND CATEGORY</b></u> (to be filled out by the Architect or Contractor)	<u><b>SUPPLIER</b></u> (to be filled out by the Contractor)	<u><b>MANUFACTURER</b></u> (to be filled out by the Contractor)
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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.**

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	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
1.	"Thermostat" Control System Installed		Per Each
2.	120 V, 20 A Duplex Outlet w/ Conduit & Wiring		Per Each
3.	120 V, 20 A Ground Faut Outlet w/ Conduit & Wiring		Per Each
4.	Conduit (3/4") EMT		Per Linear Foot
5.	3, #12 Type THHN Conductor		Per Linear Foot
6.	3, #10 Type THHN Conductor		Per Linear Foot
7.	CAT6A Data Cable		Per Linear Foot
8.	Non-Metallic Surface Mount Raceway		Per Linear Foot
9.	Metallic Surface Mount Raceway		Per Linear Foot
10.	Flush Wood Door		Per Each, Per Spec Sec. 08 14 16
11.	Flush Wood Door w/ Vision Lite		Per Each, Per Spec Sec. 08 14 16
12.	Flush Hollow Metal Door		Per Each, Per Spec Sec. 08 11 13
13.	Flush Hollow Metal Door w/ Vision Lite		Per Each, Per Spec Sec. 08 11 13
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	<b><u>WORK</u></b> (to be filled out by the Architect)	<b><u>PRICE / UNIT</u></b> (to be filled out by the Contractor)	<b><u>UNIT</u></b> (to be filled out by the Contractor)
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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.**

	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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	<b><u>SUPPLIER</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER DESCRIPTION</u></b> (to be filled out by the Contractor)	<b><u>PURCHASE ORDER AMT.</u></b> (to be filled out by the Contractor)
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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  
NAME: \_\_\_\_\_  
Signature

REPRESENTATIVE'S

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.~~ \$100,000. (change effective June 3, 2019.)**

**This form shall not be modified.**

**SECTION 002010**

**SUPPLEMENTAL FORM OF PROPOSAL**

TODD COUNTY SCHOOLS UPGRADE PROJECTS  
Todd County, Kentucky

**SUPPLEMENTAL FORM OF PROPOSAL FOR BID BREAKOUT ITEMS**

Bid breakout items as listed under “Special Instructions” must be listed and submitted with the bid.

Provide list of manufacturers and suppliers for each item.

<u>Description</u>	<u>Manufacturer</u>	<u>Supplier</u>
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**(End of Section 002010)**

# Kentucky Department of Education Version of AIA® Document A201™ – 2007

## General Conditions of the Contract for Construction

for the following PROJECT:  
(Name and location or address)

THE OWNER:  
(Name, legal status and address)

THE ARCHITECT:  
(Name, legal status and address)

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- 3 CONTRACTOR
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- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES



This version of AIA Document A201–2007 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A201 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A201–2007 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.

Init.

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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 a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 The Work

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

#### § 1.1.4 The Project

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

#### § 1.1.5 The Drawings

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

#### § 1.1.6 The Specifications

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

#### § 1.1.7 Instruments of Service

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

#### § 1.1.8 Initial Decision Maker

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

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

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

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

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

### **§ 1.3 Capitalization**

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

### **§ 1.4 Interpretation**

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

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

**§ 1.5.1** The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and 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’s 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 Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

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

### **§ 2.2 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.

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

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

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

### **§ 2.3 Owner's Right to Stop the Work**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or 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 Architect's 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. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 General**

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

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

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

### **§ 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 Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for



information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall 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 instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

### **§ 3.4 Labor and Materials**

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

**§ 3.4.2** Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order 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 and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further

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

### § 3.6 Taxes

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

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

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

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

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

### § 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

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

### § 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

### § 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

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

### § 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

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

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

### § 3.11 Documents and Samples at the Site

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, 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 shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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

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

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

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

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

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

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

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

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

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

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

concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### **§ 3.13 Use of Site**

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

### **§ 3.14 Cutting and Patching**

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

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### **§ 3.15 Cleaning Up**

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

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

### **§ 3.16 Access to Work**

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

### **§ 3.17 Royalties, Patents and Copyrights**

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

### **§ 3.18 Indemnification**

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

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

## ARTICLE 4 ARCHITECT

### § 4.1 General

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

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

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

### § 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment, and, at the discretion of the Owner may be the Owner's representative during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

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

#### § 4.2.4 Communications Facilitating Contract Administration

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

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

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

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance

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

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

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

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

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

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

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

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

## **ARTICLE 5 SUBCONTRACTORS**

### **§ 5.1 Definitions**

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

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

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

**§ 5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design)

proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

### **§ 5.3 Subcontractual Relations**

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

### **§ 5.4 Contingent Assignment of Subcontracts**

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

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

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

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

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



## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

### § 6.2 Mutual Responsibility

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

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

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

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

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

### § 6.3 Owner's Right to Clean Up

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

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

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

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

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

§ 7.1.4 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

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

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

## § 7.3 Construction Change Directives

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

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

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

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

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

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

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

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit not to exceed fifteen (15%) of the net cost of the change. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

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

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

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

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

#### **§ 7.4 Minor Changes in the Work**

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

### **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 or Architect, or of an employee of either, or of a separate contractor employed by the Owner; 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 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.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 Contract Sum**

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

### **§ 9.2 Schedule of Values**

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

### **§ 9.3 Applications for Payment**

**§ 9.3.1** At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage as stipulated in Section 9.3.4.

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

**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or 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.

**§ 9.3.4** 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 Section 9.8. herein. 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.

#### **§ 9.4 Certificates for Payment**

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

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

#### **§ 9.5 Decisions to Withhold Certification**

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

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or 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 withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

#### § 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents or as required by state law, whichever is more restrictive, and shall so notify the Architect.

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

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

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

§ 9.6.5 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.

§ 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.

#### § 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of 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 that 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 prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

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

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, 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 shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

### **§ 9.10 Final Completion and Final Payment**

**§ 9.10.1** Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 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 Architect will prepare, and the 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 (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 Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment 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 Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**§ 9.10.4** 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.

**§ 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.

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



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

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

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

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

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

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

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

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

#### § 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 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 the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased 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, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for 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 that 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;
- .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<br>\$500,000.00 one accident/maximum each person |
| (2) Property Damage  | \$200,000.00 one accident/maximum<br>\$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   |
| (2) Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractor's Protection; Product Liability and Completed Operations; Broad Form Property Damage):  |   |
| a. General Aggregate<br>(except Products-Completed Operations)   | \$1,000,000   |
| b. Products-Completed Operations Aggregate   | \$1,000,000   |
| c. Personal/Advertising Injury<br>(per person/organization)  | \$1,000,000   |
| d. Each Occurrence<br>(Bodily Injury and Property Damage)  | \$1,000,000   |
| e. Limit per Person Medical Expense  | \$10,000  |
| f. Exclusions of Property in Contractors Care, Custody or Control will be eliminated.  |   |
| g. Property Damage Liability Insurance will provide Coverage for Explosion, Collapse, and Underground Damage.  |   |
| (3) Contractual Liability:   |   |
| a. General Aggregate   | \$1,000,000   |
| b. Each Occurrence (Bodily Injury and Property Damage)   | \$1,000,000   |
| (4) Automobile Liability:  |   |
| a. Bodily Injury   | \$500,000 Each Person<br>\$1,000,000 Each Accident                    |
| b. Property Damage   | \$500,000 Each Accident, or<br>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 filed with the Owner 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 on account of revised limits or claims paid under the General Aggregate, or both, 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 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 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**

**§ 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 Architect's and Contractor'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 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, 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, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, 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.

**§ 11.3.7** 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 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 they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, 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 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, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions 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.

### ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

#### § 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

#### § 12.2 Correction of Work

##### § 12.2.1 Before or After Substantial Completion

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

##### § 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of 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 for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

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

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

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

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, 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. 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, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

### § 13.5 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 Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (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 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 Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, 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 Architect's services and expenses shall be at the Contractor's expense.

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

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

§ 13.5.6 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.

### § 13.7 Time Limits on Claims

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

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 Termination by the Contractor

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



other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable 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 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 and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

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

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

§ 14.2.2 When any of the above reasons exist, the Owner, 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:

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

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

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

may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

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

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

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption 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 the Contract.

### **§ 14.4 Termination by the Owner for Convenience**

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

**§ 14.4.2** Upon receipt of 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 Architect, if the 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.

#### **§ 15.1.3 Continuing Contract Performance**

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

#### **§ 15.1.4 Claims for Additional Cost**

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

### § 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.

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

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

§ 15.2.6.1 Either party may, within 30 days from the date of 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.

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

**§ 15.4.4 Consolidation or Joinder**

**§ 15.4.4.1** 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.

Sample

**SECTION 003000**

**SUPPLEMENTAL CONDITIONS**

**TODD COUNTY SCHOOLS UPGRADE PROJECTS  
Todd County, Kentucky**

**PART 1 GENERAL**

**1.01 RELATION TO GENERAL CONDITIONS**

- A. The following supplements modify, change, delete from or add to the Commonwealth of Kentucky, Department of Education, Division of Facilities Management, General Conditions of the Contract for Construction AIA A132-2009.
- B. Where an article of the "General Conditions" is modified or a paragraph or clause thereof is modified or deleted by these supplements, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

**1.02 DEFINED CHANGES TO SECTION 00500a**

**ARTICLE 1 GENERAL PROVISIONS**

- 1.1.8 In the definition of "Contractor" after the work "contract" add "and/or Purchase Order."

**ARTICLE 3 CONTRACTOR**

- 3.3.1.1 It shall be the sole responsibility of the Contractor to coordinate and schedule their subcontractors, suppliers, or vendors to perform the Work outlined in the Contractor's Contract Package. At no time will the A/E take responsibility for communicating with a Contractor's subcontractors, suppliers, or vendors.
- 3.5.2 The Contractor warrants to the Owner and A/E that the materials and equipment furnished under Owner Issued Purchase Orders issued through the Contractor as outlined in Paragraph 3.6 shall comply with the requirements as outlined in Paragraph 3.5.1.
- 3.6.2 The Owner, at his discretion, may take advantage of their sales and use tax exemption status. Should the Owner choose to do so, then those items which they wish to purchase directly shall be distinctly called for in the bid documents. The "Lump Sum Price" provided by the Contractor shall be the cost basis of the Owner issued purchase order. Any unspent funds in the purchase order shall revert to the Owner.
- 3.9.2 At the sole discretion of the Owner and/or A/E, the removal of any of the Contractor's management team may be required, when, in the sole opinion of the A/E or the Owner, said person is causing disruption to the Project's progression, morale, and/or coordination.

- 3.9.3 School Calendar: Last day of school May 17th and First day of school August 3rd. All work to be completed by July 31st 2021.
- 3.9.4 Code of Conduct: All contractors with identified shirts with logo of their company and name. No alcohol on property. No smoking on school property. No fire arms on School property. No foul language. No direct contact with any students. All contractors to be verified as per KRS 160.380 (No workers with felony sex crimes allowed on school property).
- 3.9.5 All furniture and equipment in the classrooms shall be relocated to the corners of the room or in the hallway to avoid damaging of any equipment. Install plastic over to protect any computers from dust. Protect floors as per drawing notes with plastic and plywoods.
- 3.9.6 Every day clean areas of work and report if any items damaged.

#### ARTICLE 4 ADMINISTRATION OF THE CONTRACT

- 4.6.21 "Conflicts in the Contract Documents." If there is conflict within or between the Contract Documents involving quality or quantity of Work required, it is the intention of the Contract that Work of the highest quality or greatest quantity indicate or specified shall be provided. Whether or not the word "all" is used, coverage is intended to be complete, except where partial coverage is specifically and expressly noted. In all cases where an item is referred to as singular in number, it is intended that reference shall apply to as many such items as required to complete the Work. The precedence of the Contract Documents is as follows:
  - a) The Contract Agreement
  - b) The Addendum of Addenda
  - c) Division 0 and Division 1
  - d) Technical Specifications Division 2 through Division 16, inclusive
  - e) Contract Drawings
  - f) Approved Submittals

No verbal agreement or conversation with any officer, representative, agent, or employee of the Owner and/or A/E either before or after execution of this Contract shall affect or modify the terms or obligations herein contained.

#### ARTICLE 7 CHANGES IN THE WORK

- 7.3.3.1 "mutual acceptance of a lump sum price properly itemized and supported by sufficient substantiating data to permit evaluation conforming to the requirements of 7.3.6.1 through 7.3.6.6."

- 7.3.6.1 “cost of all labor plus a maximum labor burden of 25% to cover the costs for social security, Medicare, unemployment insurance, workman’s compensation, liability insurance, along with any and all fringe benefits required by agreement or custom.”
- 7.3.6.4 “cost of permit fees, and sales, use or similar taxes related to Changes in the Work; and”
- 7.3.6.6 The maximum markup for the contractor’s overhead and profit shall not exceed 15% and shall be deemed to include all home and/or branch office costs associated with the changes in his work as outlines in the change directive, performance and payment bond costs along with a reasonable profit.

## ARTICLE 8 TIME

### 8.3 DELAYS AND EXTENSIONS OF TIME

#### “Liquidated Damages”

- a) It is mutually understood and agreed by and between parties of this Contract Agreement, in execution of same, that time is of the essence of this contract. In the event that a Contractor fails to substantially complete the Work to be performed under this Contract by and at applicable Contract Completion time described in the Contract Documents, including any extensions of time granted under the General Conditions, the Contract shall pay to the Owner \$500.00 per calendar day because of delay in completing such Contact Package as and for liquidated damages, such as Owner’s increased overhead and cost of additional architectural/engineering and supervision and not as a penalty for each and every calendar day, that Contractors shall be in default. If completion dates overlap, liquidated damages shall continue at the established \$500.00 per calendar day. The amount does not increase by \$500.00 per day with the overlap of a phase.
- b) Claims for extension of time and/or relief from liquidated damages, except for weather related claims, must be made in the time allowed. Claims for an extension of time due to unusual inclement weather shall be made in writing not later than the 10th day of the month following the month in which the delay occurred.
- c) Claims for extension of time or relief from liquidated damages shall be stated in numbers of whole or half calendar days. The actual dates on which the delays(s) occurred must be stated. In case of claims for extension of time because of unusual inclement weather, such unusual inclement weather prevented the execution of major items of the work on normal working days. Calendar days shall be computed by multiplying normal workdays (5 days per week) by a factor of 1.4.
- d) Unusual inclement weather as used herein means unusually severe weather is beyond the normal weather recorded and expected for the locality and/or the season or seasons of the year. Normal weather shall be determined based on records for the station of the United States Environmental Data Service nearest



the site. Time extension shall be considered based on the “actual number” of days of 0.10” tenth of an inch in precipitation as follows:

January-8	May-6	September-9
February-5	June-3	October-7
March-4	July-8	November-4
April-8	August-5	December-9

- e) The time extension(s) for changes in the Work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The Change Order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining work will not be altered and may further provide for an equitable re-adjustment of liquidated damages pursuant to the new Contract Completion Time.
- f) Owner shall have the right to deduct liquidated damages from money in its hands otherwise due, or to become due, to Contractor or to sue and recover compensation for damages for non-performance of this contract at time stipulated herein.
- g) The A/E will perform periodic inspections during construction, a punch list inspection, and Owner’s final inspection and one punch list follow-up inspection. Should the Contract require additional inspections due to the inability to complete the Work or the punch list (no matter the reason), the Owner will withhold additional funds as ‘liquidated damages’ to compensate the A/E for these additional services. Charges will be computed at a rate of 3.5 times the direct hourly rate of the A/E’s employees plus travel cost, telephone, and printing cost.

#### ARTICLE 9 PAYMENTS AND COMPLETION

9.3.4 “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.”

#### ARTICLE 11 INSURANCE AND BONDS

11.1.8 “Notice of Cancellation” “The issuing insurance company shall provide written notice by the mail, thirty (30) days before the expiration date of cancellation of any policy in effect. This notice shall be provided to the Owner and the Construction Manager.”

11.1.2.1. Liability coverage for the Construction Manager will be provided (subject to customary exclusions for Professional Liability), by endorsement as Additional Insured on all of the Contractors Liability Policies.

11.3.1.3.1 The Owner shall obtain Property Insurance with deductibles not to exceed \$1,000.00

per occurrence. Each Contractor shall be responsible for the first \$1,000.00 per occurrence of his claim.

#### ARTICLE 13 MISCELLANEOUS PROVISIONS

- 13.2.1 The Contractor shall not assign this Agreement or its proceeds nor subcontract the whole or any part of the Contractor's Work without prior written approval of the Owner. No assignment by contractor or any right here under shall be effective and any such attempt shall be null and void. No third party shall have any right to enforce any right of the Contractor under this Contract.
- 13.2.2 If the Owner gives its consent to assignment of the Contract, in whole or in part, the Contractor shall not be relieved of its duties and obligations hereunder and shall be and remain fully responsible and liable for the acts and omissions of its assignees. Nothing herein shall prevent Contractor from engaging subcontractors to perform a portion of the Work hereunder. However, Contractor shall be and remain as fully responsible for all persons directly or indirectly employed by such subcontractors, as Contractor is for its own acts and omissions and those of its agents, servants and employees.
- 13.2.3 Nothing herein shall prevent any guarantor or surety of the Contractor from enforcing any right hereunder after acknowledgment of its obligation in guarantor or surety. Any attempted enforcement of such rights in the absence of an express acknowledgement shall constitute an admission by any guarantor or surety of its obligation under its agreement of guarantee or suretyship.

**(End of Section 003000)**

Board of Education: \_\_\_\_\_

**BG#** \_\_\_\_\_

\_\_\_\_\_

District PO Number: \_\_\_\_\_

\_\_\_\_\_

**(THIS PURCHASE ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES AND SHIPPING PAPERS)**

\_\_\_\_\_

Project Name: \_\_\_\_\_

Kentucky Sales Tax Exemption Number: \_\_\_\_\_

Bid Package No.: \_\_\_\_\_

Date of Order: \_\_\_\_\_

Specification Section: \_\_\_\_\_  
(IF APPLICABLE)

Vendor Name: \_\_\_\_\_

Material Description / Category: \_\_\_\_\_

Vendor Address: \_\_\_\_\_

Facility Name: \_\_\_\_\_

\_\_\_\_\_

Requested By: \_\_\_\_\_

Vendor Phone: \_\_\_\_\_

**AUTHORIZATION**

THE ATTACHED TERMS & CONDITIONS ARE HEREBY ACKNOWLEDGED AND MADE PART OF THIS ORDER.

Vendor Email: \_\_\_\_\_

Bill To: \_\_\_\_\_

Owner Authorized Name: \_\_\_\_\_

Bill to Address: \_\_\_\_\_

Owner Authorized Signature: \_\_\_\_\_

\_\_\_\_\_

Owner Authorization Date: \_\_\_\_\_

Ship To: \_\_\_\_\_

Vendor Authorized Name: \_\_\_\_\_

Ship to Address: \_\_\_\_\_

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.	
<b>SPECIMEN COPY ONLY</b>				

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**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 AIA<sup>®</sup> Document A101<sup>™</sup> – 2007

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



This version of AIA Document A101<sup>™</sup>–2007 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A101–2007 does not imply the American Institute of Architects’ endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A101–2007 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 A101<sup>™</sup>–2007, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum — KDE Version,” or “AIA Document A101<sup>™</sup>–2007 — KDE Version.”

# Kentucky Department of Education Version of AIA® Document A101 – 2007

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

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

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

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

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

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

The Owner and Contractor agree as follows.



This version of AIA Document A101–2007 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A101 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A101–2007 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.

## TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 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 a Modification, appears in Article 9.

### ARTICLE 2 THE WORK OF THIS CONTRACT

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

### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

**§ 3.1** The date of commencement of the Work shall be 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 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.

Init.

/

**§ 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 Work**

**Substantial Completion Date**

, subject to adjustments of this Contract Time as provided in the Contract Documents.

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

(\$ ), subject to additions and deductions 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.)*

	<b>Amount</b>
Base Bid	\$
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	\$
Contract Sum (total construction cost less Owner direct Purchase Orders)	\$



**§ 4.2** The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

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

Number	Item Description	Amount
<b>Total of Alternates</b>		

**§ 4.3** Unit prices, if any:

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

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

**§ 4.4** Allowances included in the Contract Sum, if any:

*(Identify allowance and state exclusions, if any, from the allowance price. Either list allowances here or refer to an exhibit attached to this Agreement.)*

Item	Price
------	-------

## ARTICLE 5 PAYMENTS

### § 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

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

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the \_\_\_\_\_ day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the \_\_\_\_\_ day of the \_\_\_\_\_ month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than \_\_\_\_\_ ( ) days after the Architect receives the Application for Payment.

State law (KRS 371.405) requires the Owner to pay undisputed Applications for Payment within forty-five (45) business days following receipt of the invoices. If the Owner fails to pay the Contractor within forty-five (45) business days following receipt of an undisputed Application for Payment, state law requires the Owner shall pay interest to the Contractor beginning on the forty-sixth business day after receipt of the Application for Payment, computed at the rate required by state law.

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

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

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

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of \_\_\_\_\_ percent ( \_\_\_\_\_ %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™-2007, General Conditions of the Contract for Construction — KDE Version;
- .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 Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201-2007 — KDE Version.

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

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and  
(Section 9.8.5 of AIA Document A201-2007 — KDE Version requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

Init.

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

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

*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.*

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

**§ 5.2 FINAL PAYMENT**

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

- .1 the Contractor has fully performed the Contract except for the Contractor’s responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007 — KDE Version, and to satisfy other requirements, if any, which extend beyond final payment;
- .2 a final Certificate for Payment has been issued by the Architect; and
- .3 the Contractor provides the Owner with affidavits that all payrolls, bills for materials, supplies and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied, and with Consent of Surety for final payment.

**ARTICLE 6 DISPUTE RESOLUTION**

**§ 6.1 INITIAL DECISION MAKER**

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007 — 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 A201–2007 — 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 A201–2007 — KDE Version
- Litigation in a court of competent jurisdiction where the Project is located
- Other: *(Specify)*

## ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007 — KDE Version.

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

## ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 — 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 such rate 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. *(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 A101–2007, Standard Form of Agreement Between Owner and Contractor — KDE Version.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction — KDE Version.

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

Document	Title	Date	Pages
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§ 9.1.4 The Specifications:  
*(Either list the Specifications here or refer to an exhibit attached to this Agreement.)*

Section	Title	Date	Pages
---------	-------	------	-------

**§ 9.1.5** The Drawings:

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

Number	Title	Date
--------	-------	------

**§ 9.1.6** The Addenda, if any:

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

Number	Date	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:

- .1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following
  
- .2 Other documents, if any, listed below:

*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 — 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 A701–1997, 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 A201–2007 – KDE Version.

*(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007 – 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 entered into as of the day and year first written above.

\_\_\_\_\_  
OWNER *(Signature)*

\_\_\_\_\_  
CONTRACTOR *(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

\_\_\_\_\_  
*(Printed name and title)*

Init.  
/

DATE: \_\_\_\_\_

(Name of Owner)

RE:

Gentlemen:

In the bid submitted by \_\_\_\_\_ for Bid Division No. \_\_\_\_\_ of the \_\_\_\_\_ Project, the undersigned is listed as the supplier for certain materials designed therein, at a cost of \$ \_\_\_\_\_.

Base Bid:	\$	_____
Alternate # _____	\$	_____
Alternate # _____	\$	_____
Alternate # _____	\$	_____

This is to acknowledge and authorize that:

1. \_\_\_\_\_ was authorized to make the representation to the Owner that the undersigned will provide the materials designated in said bid, for the price stated therein; and
2. If \_\_\_\_\_ is awarded a contract for Bid Division No. \_\_\_\_\_ of such Project, the undersigned will enter into a Purchase Order with the Owner, on the standard Purchase Order included in the information to Bidders, to supply such materials for the price stated, and will guarantee and warrant performance to provide that such materials fully comply with the contract documents relating thereto; and
3. This commitment, acknowledgement, and authorization cannot be revoked during the time allowed by you to accept the bid of \_\_\_\_\_ or during any extended time for acceptance agreed to by \_\_\_\_\_.

Sincerely,

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

State of \_\_\_\_\_ County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 19 \_\_\_\_\_

\_\_\_\_\_ My Commission Expires \_\_\_\_\_

Review for basic compliance with Contract Documents:

BY: (Construction Manager) \_\_\_\_\_

BY: (Architect or Engineer) \_\_\_\_\_



TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I, \_\_\_\_\_, being a duly authorized representative of  
(name)  
\_\_\_\_\_ the manufacturer, and/or  
(company name)  
distributor and/or sales representative of \_\_\_\_\_,  
(product name)

do hereby certify that the above named product complies in strict accordance with the Contract Documents for the  
construction of \_\_\_\_\_ located in  
(project name)

\_\_\_\_\_, and that the product is compatible  
(project address)  
and fit for the intended use and incorporation into this project.

Further, I understand that the Architect and Owner may rely on this certification.

\_\_\_\_\_  
(Signed)

\_\_\_\_\_  
(Date)

Attached is supporting information.

**SECTION 003035**

**SPECIAL CONDITIONS**

**TODD COUNTY SCHOOLS UPGRADE PROJECTS**  
Todd County, Kentucky

**Index:**

1. Definitions
2. General
3. Architect/Engineer's Work Product
4. Administration of the Contract
5. Conflicts
6. Workmanship
7. Drawings and Specifications
8. Division of Specifications
9. Allocation of Work
10. Notice and Service Thereof
11. Codes and Ordinances
12. Substantial Completion, Final Completion and Subsequent Reviews
13. Storage of Materials
14. Layout of Building
15. Damaged Facilities
16. Unit Prices
17. Rules of Measurement
18. Interruption of Utilities
19. Contractor Coordination
20. Miscellaneous Provisions
21. The Kentucky Fairness Construction Act

## **1. DEFINITIONS**

- a) The term "OWNER" as used throughout these documents means the Todd County Board of Education, Elkton, KY 42220.
- a) The term "ARCHITECT" as used throughout these documents means Deco Architects, Inc., 127 Old Monticello Street, Suite 1, Somerset, KY 42501.
- b) The term "ENGINEER" as used throughout these documents means SKY Engineer, 1830 Destiny Lane, Suite 113, Bowling Green, KY 42104.
- c) The abbreviation "A/E" refers to Architect/Engineer.
- d) The term "PLANS" and "DRAWINGS" are used interchangeably and are construed to have the same meaning.

## **2. GENERAL**

- a) These specifications and drawings accompanying them describe the work to be done and the materials to be furnished for Todd County Schools Upgrade Projects.
- b) Should any error or inconsistency appear in the Drawings or Specifications, the Contactor, before proceeding with the work, must make mention of the same to the A/E for proper adjustment and in no case proceed with the work in uncertainty or with insufficient drawings.
- c) The work under this contract does not include any items marked "NIC" on the drawings (not in contract).
- d) Contractors shall follow sizes in specifications or figures on drawings, in preference to scale measurements and follow detail drawings in preference to general drawings.
- e) Where is obvious that a drawing illustrates only a part of a given work, of a number of items, the remainder shall be deemed repetitious and so constructed.

## **3. A/E WORK PRODUCT**

- a) The A/E work product is prepared and produced for the sole and exclusive benefit of the Owner. Any real or inferred benefits to third parties are hereby expressly disclaimed.

## **4. ADMINISTRATION OF THE CONTRACT**

- a) The A/E will perform certain administrative functions of the construction contract. Nothing contained in these contract documents, nor any other oral or written agreements, memoranda, or communications shall create any express or implied contractual relationship between the A/E and the Contractor.

- b) The A/E may make periodic visits to the work site in accordance with the conditions of his contract with the Owner. The purpose of these visits and observations is to endeavor to guard against defects and deficiencies, not to supervise the Contractor's work.
- c) The A/E makes no express or implied representations of guaranteeing the Contractor's work.
- d) The A/E is not a specialist in construction methods, techniques, sequences or procedures and therefore assumes no responsibility for the construction operations and safety program.

#### **5. CONFLICTS**

- a) If there is any conflict in the General Conditions with the Special Conditions, the Special Conditions shall govern.

#### **6. WORKMANSHIP**

- a) The workmanship shall be of the highest quality, in every respect, as usually recognized in the building industry. Poor or inferior workmanship (as determined by the Construction Manager, Architect, Engineers or inspecting authorities) is to be removed and replaced to conform to the highest quality standards of the trades concerned, or otherwise corrected.

#### **7. DRAWINGS AND SPECIFICATIONS**

- a) The drawing dimensions shall have precedence over scaled measurements and details over general drawings. In case of conflicts between Drawings and Specifications, the more stringent shall apply.
- b) Figured dimensions on the drawings are reasonably accurate and should govern in setting out the work. However, should the Contractor discover discrepancies or inaccuracies, it shall be the Contractor's responsibility to bring them to the attention of the A/E before making any changes. Changes shall be made only with the approval of the A/E.
- c) If there is a conflict within or between contract documents involving quality or quantity of work required, it is intention of contract that work of highest quality or greater quantity indicated or specified shall be provided. Whether or not the word "all" is used, coverage is specifically and expressly noted. In all cases where an item is referred to in singular number, it is intended that reference shall apply to as many such items as are required to perform the work.

#### **8. DIVISION OF SPECIFICATIONS**

- a) Division of Specifications into sections is done for convenience of reference is not intended to control contractors in dividing work among subcontractors or to limit scope of work performed by any trade under any given section.

## **9. ALLOCATION OF WORK**

- a) Where certain materials are specified to be installed under various headings, it shall be the responsibility of the Contractor to re-allocate such work under the proper subcontractor if the specification is in conflict with local jurisdiction.

## **10. NOTICE AND SERVICE THEREOF**

- a) Any notice to any Contractor from the Owner relative to any part of this contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted, by registered mail, to the said Contractor at his last address, or delivered in person to said Contractor or his authorized representative on the work.

## **11. CODES AND ORDINANCES**

- a) All branches of the work shown on the plans or specified, whether specifically mentioned or not, 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.

## **12. SUBSTANTIAL COMPLETION, FINAL COMPLETION, & SUBSEQUENT REVIEWS**

- a) In as much as all parties with and intend to prosecute the work in a diligent and good faith manner, and to complete the work in a timely fashion, the Contractor shall notify the A/E when the Contractor believes he has attained Substantial Completion. Notification in writing shall be made at least five (5) calendar days prior to the date set to the Substantial Completion review. The Contractor shall comply with the pre-requisite requirements for Substantial Completion as set forth in Section 01650 – Progress Payment and Closeout Procedures.
- b) Review Procedures – Upon receipt of the Contractor’s request, the A/E will either proceed with review or advise Contractor of prerequisites not fulfilled. Following initial review, the A/E will either prepare a certificate of substantial completion or advise the Contractor of work which must be performed prior to issuance of the certificate of substantial completion. The A/E will repeat the review when requested and assured by the Contractor, in writing, that the Work has been substantially completed. Results of the completed review will form the initial “punch list” for final acceptance.
- c) The A/E will review the work upon the receipt of the Contractor’s notice that they believe in good faith that, except for those items whose completion has been delayed due to circumstances that are acceptable to the A/E, the work has been completed, including punch list items from earlier reviews. Upon completion of review, the A/E will either recommend final acceptance and final payment or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance by issuance of another punch list.

- d) The Contractor, upon completion of all outstanding items set forth on the punch list, shall notify the A/E of the completion of the work. The A/E shall verify completion of the work by an on-site review.
- e) In the event that the work should still require further reviews after initial post final review, unless through no fault of the Contractor, the Contractor shall authorize the Owner to deduct from the remaining available construction funds those monies which represent the Architect's normal hourly compensation rates and normal expenses for any additional time and expense expended on this project by the A/E. Hourly rates and expense reimbursement rates will be governed by those rates stipulated in the Agreement Between the Owner and A/E. The disbursement of available construction funds by the Owner to the A/E in the foregoing situation, described therein, shall represent only actual charges associated with the expenditure of the A/E's time and expense and in no way represent a penalty assessed to the Contractor.
- f) Substantial Completion: The General Conditions are modified as follows: "Substantial Completion" is the point at which, as certified in writing by the Owner and A/E, the project is at the level of completion, in strict compliance with the contract, where:
  - Necessary approval by public regulatory authorities has been given;
  - The Owner has received all required project warranties and documentation; and
  - The Owner may enjoy beneficial use or occupancy and may use, operate, and maintain the project in all respects, for its intended purpose.
  - Partial use or occupancy shall not necessarily result in the project being deemed Substantially complete and shall not be evidence of substantial completion.

### **13. STORAGE OF MATERIALS**

- a) Each Contractor providing materials and equipment shall be responsible for the proper and adequate storage of their materials and equipment, and for the removal of same upon completion of their work. Storage of materials at the site shall be confined to areas within the Contract Limits, and the Contractor's designated parking area if necessary, where Designated by the Owner and A/E.

### **14. LAYOUT OF BUILDING**

- a) Each Contractor shall lay out the work and be responsible for all lines, levels and measurements of all work executed under this Contract; they shall verify the figures before laying out the work and will be held responsible for any error resulting from their failure to do so.
- b) Each Contractor shall be prepared to guarantee each of their subcontractors the dimensions, which they may require for the layout and fitting of their work to the surrounding work.

**15. DAMAGED FACILITIES**

- a) Each Contractor shall repair and/or replace, at no expense to the Owner, any sections of existing roads, drives, streets, sidewalks, curbs, utilities, buildings and other structures damaged by reason of work performed under this Contract or incidental thereto, whether by their own forces or by their Subcontractors or by their Material Suppliers.

**16. UNIT PRICES**

- a) The Unit Price for each of the items set forth in the Form of Proposal shall become a part of the Contract.
- b) All Unit Prices are subject to review by the Owner and A/E prior to being accepted for contract purposes.
- c) All Subcontractors shall be bound by the Unit Prices of each Contractor.
- d) It is mutually understood and agreed that such Unit Prices include all items of costs, overhead and profit for the Contractor and any Subcontractor(s) involved, and that they shall be uniformly without modification for either additions or deductions.
- e) The Rules of Measurement, as specified in Paragraph 17 of this Section, shall apply in the use of Unit Prices.
  - 1. Each Unit Price involving earthwork shall cover, among other things, engineering (surveying) costs and all costs of keeping excavations dry.

**17. RULES OF MEASUREMENT**

- a) The following Rules of Measurement shall apply in the use of Unit Prices.
  - 1. Except as provision is made hereinafter for arbitrary measurements, the quantity of excavation shall be its in-place volume before removal.
  - 2. No allowance will be made for excavating additional material of any nature taken out for the convenience of the Contractor, beyond the quantity computed under these Rules of Measurement.
  - 3. The quantities of excavation shall be computed from instrument readings in vertical cross sections located at such intervals as will assure accuracy.
  - 4. General excavation for buildings and sections of buildings, bases for equipment, sump pits, etc., involving an area of 200 or more square feet, shall be classified as "Mass Excavation".
  - 5. Excavation for pipes, wall footings, grade beams, column footings and sections of buildings such as bases for equipment, sump pits, etc., involving an area less than 200 square feet, shall be classified as "Trench Excavation".

6. "Mass Excavation" shall arbitrarily be assumed to extend to vertical planes two feet (2') outside wall lines, and to the elevation of plan sub grade.
7. "Trench Excavation" for walls, grade beams and sections of building, such as bases for equipment, sump pits, etc., involving an area less than 200 square feet shall be arbitrarily assumed to extend two feet (2') wider than wall and grade beam thicknesses and outside walls of sections of buildings such as bases for equipment, sump pit, etc., but in no case less than three feet (3') wide sides vertical.
8. "Trench Excavation" for pipes shall arbitrarily be assumed to be two feet (2') wider than the outside diameter of the pipe barrel and with sides vertical.
9. "Trench Excavation" for wall footings and column footings shall be computed as vertical shafts, each with a horizontal cross section identical in shape and size with the plan of the footing.
10. The quantities of form work will be the area of forms in contact with concrete.
11. Concrete quantities shall be computed from plan size or if there are no drawings, from actual measurement of the work ordered and placed, waste excluded.

#### **18. INTERRUPTION OF UTILITIES**

- a) Utility services to existing facilities shall not be interrupted unless absolutely necessary. Interruptions shall be of minimum duration and shall be scheduled to cause the least possible inconvenience. In all cases, the owner shall be notified well in advance of an anticipated interruption of utilities.

#### **19. CONTRACTOR COORDINATION**

- a) Each Contractor and all Subcontractors and other on-site contractors shall cooperate and coordinate their work to expedite the progress of the project. All Subcontractors shall review and refer to the drawings and specifications of other trades involved with their particular work before proceeding. Any work installed which conflicts with another trade and had not been brought to the attention of the A/E prior to installation shall be removed and reinstalled at no additional expense to the Owner.

#### **20. MISCELLANEOUS PROVISIONS**

- a) None of the Bidding Documents or Contract Documents prepared for this project, including, but not limited to all contracts, drawings, or specifications, shall be construed against the party preparing any document on the ground that the party prepared or drafted the document, or any portion thereof.



**21. THE KENTUCKY FAIRNESS IN CONSTRUCTION ACT**

- a) 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.
  
- b) Compliance with KRS 45A.343: Within 10 days after award of the contract and as required by KRS 45A.343, section (2)(a), each Contractor and all Subcontractors performing work under the contract shall in writing to the Owner reveal any final determination of a violation by the Contractor or Subcontractor within the previous 5 year period pursuant to KRS Chapters 136, 139, 141, 337, 338, 341, and 342 that apply to the Contractor or Subcontractor. As required by KRS 45A.343, Section (2)(b), Contractors and Subcontractors performing work under the contract shall be in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341, and 342 that apply to the Contractor or Subcontractor for the duration of the Contract.

**(End of Section 003035)**

# Kentucky Department of Education Version of AIA® 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

Company: \_\_\_\_\_  
(Corporate Seal)

### SURETY

Company: \_\_\_\_\_  
(Corporate Seal)

Signature: \_\_\_\_\_  
Name  
and Title:  
(Any additional signatures appear on the last page of this Payment Bond.)

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

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**  
(Architect, Engineer or other party:)



This version of AIA Document A312–2010 is modified by the Kentucky Department of Education. Publication of this version of AIA Document A312 does not imply the American Institute of Architects' endorsement of any modification by the Kentucky Department of Education. A comparative version of AIA Document A312–2010 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.

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.

**§ 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

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.

§ 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 PRINCIPAL**

**SURETY**

Company:

*(Corporate Seal)*

Company:

*(Corporate Seal)*

Signature: \_\_\_\_\_

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

Address \_\_\_\_\_

Signature: \_\_\_\_\_

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

Address \_\_\_\_\_

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**SECTION 04 20 00  
UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 05 11 - Mortar and Masonry Grout.

**1.03 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).
- C. ASTM C55 - Standard Specification for Concrete Building Brick 2017.
- D. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.
- F. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- G. ASTM C150/C150M - Standard Specification for Portland Cement 2020.
- H. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2019.
- I. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
- J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- K. ASTM C476 - Standard Specification for Grout for Masonry 2020.
- L. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2016.
- M. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

**PART 2 PRODUCTS**

**2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm). Confirm existing wall to be demolished is 8 inches and not 4 inches before ordering material.
  - 2. Non-Loadbearing Units: ASTM C129.
    - a. Hollow block, as indicated.
    - b. Lightweight.

**2.02 MORTAR AND GROUT MATERIALS**

- A. Masonry Cement: ASTM C91/C91M, Type N.
  - 1. Colored Mortar: Premixed cement as required to match Architect's color sample.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Mortar Aggregate: ASTM C144.

- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.
- F. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
  - 1. Color: Standard gray.
- G. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

### **2.03 REINFORCEMENT AND ANCHORAGE**

- A. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

### **2.04 ACCESSORIES**

- A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - b. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

### **2.05 MORTAR AND GROUT MIXING**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Interior, non-loadbearing masonry: Type O.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### **3.03 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Match adjacent.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
  - 3. Mortar Joints: Match adjacent.

### **3.04 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

**3.05 TOLERANCES**

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

**3.06 CUTTING AND FITTING**

- A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

**3.07 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

**3.08 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 07 41 13  
METAL ROOF PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Architectural roofing system of preformed steel panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2010 (Reapproved 2015).
- D. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Storage and handling requirements and recommendations.
  - 2. Installation methods.
  - 3. Specimen warranty.
- C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
  - 1. Show work to be field-fabricated or field-assembled.
- D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.
- E. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

**1.06 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.
- C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design:
  - 1. Metal Roof Panels: BattenLok HS manufactured by MBCI.

2. Metal Roof Panels: MAC LOC manufactured by Mac Metal Roofing and Siding.
- B. Other Acceptable Manufacturers; Metal Roof Panels:
1. Fabral; Stand N Seam: [www.fabral.com/#sle](http://www.fabral.com/#sle).

## **2.02 ARCHITECTURAL METAL ROOF PANELS**

- A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.
- B. Metal Panels: Factory-formed panels with factory-applied finish.
1. Steel Panels:
    - a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
    - b. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
    - c. Steel Thickness: Minimum 24 gage (0.024 inch) (0.61 mm).
  2. Profile: Standing seam, with minimum 1.0 inch (25 mm) seam height; concealed fastener system for field seaming with special tool.
  3. Texture: Smooth.
  4. Length: Full length of roof slope, without lapped horizontal joints.
  5. Width: Maximum panel coverage of 12 inches (305 mm).

## **2.03 ATTACHMENT SYSTEM**

- A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

## **2.04 FABRICATION**

- A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.
- B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

## **2.05 FINISHES**

- A. Fluoropolymer Two-Coat System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 621; color and gloss to match sample.

## **2.06 ACCESSORIES**

- A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.
- B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- C. Sealants:
1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
  2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
  3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

**3.02 PREPARATION**

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.
- C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
- D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

**3.03 INSTALLATION**

- A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
  - 1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
  - 2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
- B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.
- C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

**3.04 CLEANING**

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

**3.05 PROTECTION**

- A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

**END OF SECTION**

**SECTION 07 62 00  
SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.

**1.02 RELATED REQUIREMENTS**

- A. Section 074113 - Metal Roofing.
- B. Section 07 71 00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.
- C. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- I. CDA A4050 - Copper in Architecture - Handbook current edition.
- J. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Maintain one copy of each document on site.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sheet Metal Flashing and Trim Manufacturers:
  - 1. Fairview Architectural LLC; VitraEdge [\_\_\_\_]: [www.fairview-na.com/#sle](http://www.fairview-na.com/#sle).

2. MBCI; coordinate with final roofing color selections..
3. MAC Metal Sales
4. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 SHEET MATERIALS**

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
  1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  2. Color: As selected by Architect from manufacturer's standard colors.
- B. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; anodized finish of color as selected.
  1. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils (0.018 mm) thick.
- C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) (0.81 mm) thick; plain finish shop pre-coated with modified silicone coating.
  1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
  2. Color: As selected by Architect from manufacturer's standard colors.

## **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

## **2.04 GUTTER AND DOWNSPOUT FABRICATION**

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Downspouts: Rectangular profile.
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- D. Accessories: Profiled to suit gutters and downspouts.
  1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
  2. Gutter Supports: Brackets.
  3. Downspout Supports: Brackets.
- E. Downspout Boots: Steel.
- F. Downspout Extenders: Same material and finish as downspouts.
- G. Seal metal joints.

## **2.05 EXTERIOR PENETRATION FLASHING PANELS**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

## **2.06 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: Polyethylene, 6 mils (0.15 mm) thick.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.



- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- G. Plastic Cement: ASTM D4586/D4586M, Type I.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

**3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

**3.03 INSTALLATION**

- A. Comply with drawing details.
- B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Secure gutters and downspouts in place with concealed fasteners.
- G. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
- H. Connect downspouts to downspout boots, and seal connection watertight.
- I. Set splash pads under downspouts, and set in place with [\_\_\_\_\_].

**END OF SECTION**

**SECTION 07 72 00  
ROOF ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof walkways and platforms.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 41 13 - Metal Roof Panels.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

**1.03 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 SUBMITTALS**

- A. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
- B. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

**PART 2 PRODUCTS**

**2.01 ROOF CURBS**

- A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
  - 1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
  - 2. Sheet Metal Material:
    - a. Aluminum: 0.080 inch (2.03 mm) minimum thickness, with 3003 alloy, and H14 temper.
  - 3. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
    - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch (152 mm) clearance between curb and metal roof panel flange allowing water to properly flow past curb.
    - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.

- c. Maintain at least 12 inch (305 mm) clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
- d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
- 4. Provide layouts and configurations indicated on drawings.
- B. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
  - 1. Provide preservative treated wood nailers on exterior face of curb.
  - 2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.
  - 3. Height Above Roof Deck: 14 inches (356 mm), minimum.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.

## **2.02 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES**

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
  - 1. Design Loadings and Configurations: As required by applicable codes.
  - 2. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 4. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

### **3.04 CLEANING**

- A. Clean installed work to like-new condition.

### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 07 92 00  
JOINT SEALANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping: Firestopping sealants.
- B. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- C. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

**1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2014.
- H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
- I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).
- J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.
- K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- L. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).
- M. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

### 1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

## PART 2 PRODUCTS

### 2.01 JOINT SEALANT APPLICATIONS

- A. Scope:
  - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    - a. Wall expansion and control joints.
    - b. Joints between door, window, and other frames and adjacent construction.
    - c. Joints between different exposed materials.
    - d. Openings below ledge angles in masonry.
    - e. Other joints indicated below.
  - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. Other joints indicated below.
  - 3. Do not seal the following types of joints.
    - a. Intentional weepholes in masonry.
    - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    - d. Joints where installation of sealant is specified in another section.
    - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
  - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
  - 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
  - 3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
  - 4. Wiring Slots in Concrete Paving: Self-leveling epoxy sealant.
  - 5. Cooling Tower and Fountain Basins: Non-sag polyurethane sealant for continuous immersion.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
  - 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
  - 4. Wall, Ceiling, and Floor Joints Where Tamper-Resistance is Required: Non-sag tamper-resistant silyl-terminated polyurethane sealant.
  - 5. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
  - 6. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
  - 7. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
  - 8. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

- F. Areas Where Tamper-Resistance is Required: As indicated on drawings.

## 2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: As indicated on drawings.

## 2.03 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  5. Color: Match adjacent finished surfaces.
  6. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
  7. Manufacturers:
    - a. ADFAST Corporation; ADSEAL LM 4600 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. ADFAST Corporation; ADSEAL DWS 4580 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - c. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - e. Sika Corporation; Sikasil WS-290: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - f. Sika Corporation; Sikasil WS-295: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - g. Sika Corporation; Sikasil 728NS: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - h. Tremco Commercial Sealants & Waterproofing; Spectrem 1: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - i. Tremco Commercial Sealants & Waterproofing; Spectrem 2: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - j. Tremco Commercial Sealants & Waterproofing; Spectrem 3: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - k. Tremco Commercial Sealants & Waterproofing; Spectrem 4-TS: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- B. Silicone Sealant: ASTM C920, Grade NS, Use T; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
  2. Color: To be selected by Architect from manufacturer's standard range.
  3. Manufacturers:
    - a. Dow Chemical Company; DOWSIL NS Parking Structure Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - b. Pecora Corporation; Pecora 301 NS (Non-Sag): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Spectrem 800: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- C. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: Match adjacent finished surfaces.
  4. Cure Type: Single-component, neutral moisture curing
  5. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
  6. Manufacturers:
    - a. ADFAST Corporation; ADSEAL Production 4550 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).

- b. Everkem Diversified Products, Inc; EvoSeal MS:  
[www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
  - c. Pecora Corporation; Pecora 860: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - d. Pecora Corporation; Pecora 890FTS (Field Tintable Smooth):  
[www.pecora.com/#sle](http://www.pecora.com/#sle).
  - e. Pecora Corporation; Pecora 890FTS-TXTR (Field Tintable Textured):  
[www.pecora.com/#sle](http://www.pecora.com/#sle).
  - f. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - g. Sika Corporation; Sikasil GP: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - h. Sika Corporation; Sikasil WS-295: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - i. Sika Corporation; Sikasil N-Plus US: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - j. Sika Corporation; Sikasil 728NS: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
- D. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
- 1. Color: White.
  - 2. Manufacturers:
    - a. ADFAST Corporation; ADSEAL KB 4800 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. Everkem Diversified Products, Inc; TruSil 100: [www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
    - c. Pecora Corporation; Pecora 898 NST (Non-Staining Technology):  
[www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Sika Corporation; Sikasil GP: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
- E. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
- 1. Adheres to wet surfaces.
  - 2. Color: White.
  - 3. Manufacturers:
    - a. ADFAST Corporation; ADSEAL DWSP 1940 Series: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. DAP Products Inc; DYNAFLEX 800 Sealant: [www.dapspecline.com/#sle](http://www.dapspecline.com/#sle).
- F. Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Franklin International Inc; Titebond WeatherMaster ULTIMATE MP Sealant:  
[www.titebond.com/#sle](http://www.titebond.com/#sle).
    - b. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - c. Sherwin-Williams Company; Stampede 1H Hybrid Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - d. Tremco Commercial Sealants and Waterproofing; Dymonic FC:  
[www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- G. Tamper-Resistant, Silyl-Terminated Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
- 1. Movement Capability: Plus and minus [ ] percent, minimum
  - 2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Pecora Corporation; DynaTrol I-XL Hybrid: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Pecora Corporation; DynaFlex SC (Security Sealant): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. Sika Corporation; SikaHyflex-150 LM: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).

- H. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus [ ] percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Pecora Corporation; DynaTrol II: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Pecora Corporation; DynaFlex: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - c. The QUIKRETE Companies; QUIKRETE® Polyurethane Non-Sag Sealant: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
    - d. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - e. Sherwin-Williams Company; Stampede 2NS Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - f. Sika Corporation; Sikaflex-1a: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - g. Sika Corporation; Sikaflex-15 LM: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - h. Sika Corporation; Sikaflex-2c NS: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - i. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - j. W. R. Meadows, Inc; POURTHANE NS: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- I. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Sika Corporation; Sikaflex-1a: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - b. Sika Corporation; Sikaflex-2c NS: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
- J. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
- K. Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
  - 2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Match adjacent finished surfaces.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
- L. Epoxy Sealant: ASTM C881/C881M, Type I and III, Grade 3, Class B and C; two-component.
  - 1. Hardness Range: 65 to 75, Shore D, when tested in accordance with ASTM C661.
  - 2. Color: Match adjacent finished surfaces.
  - 3. Service Temperature Range: 40 to 120 degrees F (4 to 49 degrees C).
  - 4. Manufacturers:
    - a. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant: [www.pecora.com/#sle](http://www.pecora.com/#sle).
- M. Polysulfide Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.



1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: Match adjacent finished surfaces.
  4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  5. Manufacturers:
    - a. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. W.R. Meadows, Inc; Deck-O-Seal Gun Grade: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- N. Polysulfide Sealant for Continuous Water Immersion: Polysulfide; ASTM C920, Grade NS, Uses M and A; single component; explicitly approved by manufacturer for continuous water immersion; not expected to withstand traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
  3. Color: Match adjacent finished surfaces.
  4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  5. Manufacturers:
- O. Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
  2. Hardness Range: 15 to 40, Shore A, when tested in accordance with ASTM C661.
  3. Color: White.
  4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  5. Manufacturers:
    - a. DAP Products Inc; DYNAFLEX 920 Sealant: [www.dapspecline.com/#sle](http://www.dapspecline.com/#sle).
    - b. Everkem Diversified Products, Inc; AcuraSeal: [www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
    - c. Franklin International, Inc; Titebond UA 920 Sealant: [www.titebond.com/#sle](http://www.titebond.com/#sle).
    - d. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - e. Top Gun, a brand of PPG Architectural Coatings; Top Gun 400: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
    - f. Tower Sealants, Inc; AU-1 Commercial Construction Sealant: [www.towersealants.com/#sle](http://www.towersealants.com/#sle).
- P. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).
  2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).
  3. Manufacturers:
    - a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - b. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
    - c. Pecora Corporation; AC-20 +Silicone: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - e. Sherwin-Williams Company; 850A Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - f. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - g. Sherwin-Williams Company; Bolt Quickdry Siliconized Acrylic Latex Caulk: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - h. Sherwin-Williams Company; Powerhouse Siliconized Acrylic Latex Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - i. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - j. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - k. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound Spray: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).

- Q. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
  - 1. Color: Standard colors matching finished surfaces.
  - 2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.
  - 3. Manufacturers:
    - a. Pecora Corporation; AC-20 FTR (Fire and Temperature Rated): [www.pecora.com/#sle](http://www.pecora.com/#sle).
- R. Type [ ] - Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

## 2.04 SELF-LEVELING SEALANTS

- A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
  - 1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  - 2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Dow Chemical Company; DOWSIL SL Parking Structure Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - b. Dow Chemical Company; DOWSIL FC Parking Structure Sealant: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
    - c. Pecora Corporation; Pecora 300 SL (Self-Leveling): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - d. Pecora Corporation; Pecora 322 FC (Fast Cure): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - e. Sika Corporation; Sikasil 728RCS: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - f. Sika Corporation; Sikasil 728SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
- B. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.
  - 4. Manufacturers:
    - a. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. The QUIKRETE Companies; QUIKRETE® Polyurethane Self-Leveling Sealant: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
    - c. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - d. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - e. Sika Corporation; Sikaflex-1c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - f. Sika Corporation; Sikaflex-2c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
- C. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Limestone.
  - 4. Tensile Strength: 200 to 250 psi (1.38 to 1.72 MPa) in accordance with ASTM D412.
  - 5. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; THC-901: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).

- D. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. Sika Corporation; Sikaflex-1c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - b. Sika Corporation; Sikaflex-2c SL: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
    - c. W. R. MEADOWS, Inc; POURTHANE SL: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- E. Self-Leveling Silyl-Terminated Polyether/Polyurethane (STPE/STPU) Sealant: ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
  - 1. Movement Capability: Plus and minus 35 percent.
  - 2. Hardness Range: 30 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
- F. Self-Leveling Polysulfide Sealant: ASTM C920, Grade P, Uses M and A; multicomponent; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
  - 1. Movement Capability: Plus and minus 25 percent.
  - 2. Hardness Range: 30 to 55, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: Gray.
  - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
  - 5. Manufacturers:
    - a. W.R. Meadows, Inc; Deck-O-Seal (pourable): [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - b. W.R. Meadows, Inc; Deck-O-Seal 125: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - c. W.R. Meadows, Inc; Deck-O-Seal 150: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- G. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
  - 1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
  - 2. Manufacturers:
    - a. ARDEX Engineered Cements; ARDEX ARDIFIX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
- H. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
  - 1. Color: White.
  - 2. Manufacturers:
    - a. ADFAST Corporation; Adfoam Flex 1865: [www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
    - b. DAP Products Inc; DRAFTSTOP 812 Foam: [www.dapspecline.com/#sle](http://www.dapspecline.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- I. High Quality Latex-Based Sound Sealant: ASTM C834, Type OP an opaque sealant, and Grade 0 Degrees C (32 Degrees F) meets requirements for low-temperature flexibility.
  - 1. Color: White.
  - 2. Manufacturers:
    - a. Everkem Diversified Products, Inc; Sound Seal 90: [www.everkemproducts.com/#sle](http://www.everkemproducts.com/#sle).
- J. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  - 1. Composition: Multi-component, 100 percent solids by weight.
  - 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
  - 3. Color: Concrete gray.

4. Joint Width, Minimum: 1/8 inch (3 mm).
  5. Joint Width, Maximum: 1/4 inch (6 mm).
  6. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 2 inches (51 mm) in depth including space for backer rod.
  7. Manufacturers:
    - a. Dayton Superior Corporation: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Euclid Chemical Company; EUCO 700: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. Nox-Crete; DynaFlex 502: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - d. W.R. Meadows, Inc; Rezi-Weld Flex: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- K. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
  2. Color: Concrete gray.
  3. Joint Width, Minimum: 1/8 inch (3 mm).
  4. Joint Width, Maximum: 3/4 inch (19 mm).
  5. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 1 inch (25.4 mm) in depth excluding space for backer rod.
  6. Manufacturers:
    - a. Adhesives Technology Corporation; Crackbond JF-311: [www.atcepoxy.com/#sle](http://www.atcepoxy.com/#sle).
    - b. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - c. Euclid Chemical Company; EUCO QWIKjoint UVR: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - d. Nox-Crete; DynaFlex JF-85: [www.nox-crete.com/#sle](http://www.nox-crete.com/#sle).
    - e. SpecChem, LLC; Rapid Flex CJ: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
- L. Semi-Self-Leveling Polyurethane Sealant: Intended for expansion joints in sidewalks, swimming pool decks, plazas, floors and other horizontal surfaces with up to 6 percent slope.
1. Composition: Single or multi-component.
  2. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
  3. Color: Gray.
  4. Tensile Strength: 250 to 300 psi (1.72 to 2.07 MPa) in accordance with ASTM D412.
  5. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Vulkem 445 SSL: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- M. Polyurethane-Methacrylate (PUMA) Expansion Joint System: Intended for expansion joints in exposed multi-story parking garages, and includes aluminum tape, primer, joint compound material, and top coat.
1. Durometer Hardness, Type A: 65 to 87, minimum, when tested in accordance with ASTM D2240.
  2. Top Coat Color: Gray.
  3. Tensile Strength: 752 psi (5.18 MPa) in accordance with ASTM D412.
  4. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Tremco PUMA Expansion Joint System (EJS): [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).

## 2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
  2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

3. Open Cell: 40 to 50 percent larger in diameter than joint width.
4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
5. Manufacturers:
  - a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod):  
[www.adfastcorp.com/#sle](http://www.adfastcorp.com/#sle).
  - b. Nomaco, Inc; HBR: [www.nomaco.com/#sle](http://www.nomaco.com/#sle).
- B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.
  1. Profile: As required to match existing metal glazing cap requirements.
  2. Color: As required to match existing conditions.
  3. Durometer Hardness, Type A: 65, minimum, when tested in accordance with ASTM D2240.
  4. Tensile Strength: 1139 psi (7.8 MPa), in accordance with ASTM D412.
  5. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Spectrem Restoratoin Overlay:  
[www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
  1. Size: 1 inch (25.4 mm) wide, in rolls 100 feet (30.5 m) long.
  2. Thickness: 0.78 inch (19.8 mm), with ridges along outside bottom edges for bonding area.
  3. Color: As selected by Architect..
  4. Durometer Hardness, Type A: 26 to 32, minimum, when tested in accordance with ASTM D2240.
  5. Tensile Strength: 218 psi (1.5 MPa), in accordance with ASTM D412.
  6. Elongation at Break: 554 percent, in accordance with ASTM D412.
  7. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Spectrem Simple Seal:  
[www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.
  1. Size: 1-1/2 inch (38 mm) wide, in rolls 100 feet (30.5 m) long.
  2. Thickness: 0.051 inch (1.3 mm), with ridges along outside bottom edges for bonding area.
  3. Color: Light gray.
  4. Durometer Hardness, Type A: 55, minimum, when tested in accordance with ASTM D2240.
  5. Tensile Strength: 532 psi (3.67 MPa), in accordance with ASTM D412.
  6. Elongation at Break: 690 percent, in accordance with ASTM D412.
  7. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Dymonic Simple Seal:  
[www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- E. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- F. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- G. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- H. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.

- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

**3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

**3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- G. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

**END OF SECTION**

**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Fire-rated hollow metal doors and frames.
- C. Thermally insulated hollow metal doors with frames.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

**1.03 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

**1.04 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2007 (R2011).
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.
- J. FEMA P-320 - Taking Shelter from the Storm: Building a Safe Room for Your Home or Small Business 2014.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. IEEE 299 - IEEE Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures 2006 (Reaffirmed 2012).
- M. ITS (DIR) - Directory of Listed Products current edition.
- N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

- P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
- R. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2016.
- S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- T. UL (DIR) - Online Certifications Directory Current Edition.
- U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- V. UL 752 - Standard for Bullet-Resisting Equipment Current Edition, Including All Revisions.
- W. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: [www.steeldoor.org/sdicertified.php/#sle](http://www.steeldoor.org/sdicertified.php/#sle).
- B. Maintain at project site copies of reference standards relating to installation of products specified.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Curries, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Krieger Specialty Products: [www.kriegerproducts.com/#sle](http://www.kriegerproducts.com/#sle).
  - 4. Mesker, dormakaba Group; FDJ Series Drywall Frames: [www.meskeropeningsgroup.com/#sle](http://www.meskeropeningsgroup.com/#sle).
  - 5. Republic Doors, an Allegion brand: [www.republicdoor.com/#sle](http://www.republicdoor.com/#sle).
  - 6. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  - 4. Door Edge Profile: Manufacturers standard for application indicated.
  - 5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.



- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### 2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
  - 2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
- C. Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
  - 2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
  - 3. Door Face Sheets: Flush.
- D. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
  - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
  - 3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    - a. Attach fire rating label to each fire rated unit.
  - 4. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following:
    - a. Maximum Air Leakage: 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
    - b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
    - c. Label: Include the "S" label on fire-rating label of door.
  - 5. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
  - 6. Door Face Sheets: Flush.

### 2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Knock-down type.
  - 1. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

- E. Door Frames, Fire-Rated: Knock-down type.
  - 1. Fire Rating: Same as door, labeled.
- F. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.
- G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch (102 mm) high to fill opening without cutting masonry units.
- I. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

## **2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
  - 1. Color: As indicated on drawings.

## **2.06 ACCESSORIES**

- A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.
  - 1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
- B. Glazing: As specified in Section 08 80 00, factory installed.
- C. Astragals for Double Doors: Specified in Section 08 7100.
- D. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 71 00.
- F. Touch up damaged factory finishes.

### **3.04 ADJUSTING**

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.
- C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

**3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

**SECTION 08 14 16  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; .

**1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.
- D. Section 09 91 23 - Interior Painting: Field finishing of doors.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI A135.4 - American National Standard for Basic Hardboard 2012.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2014.
- E. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2019c.
- F. AWI (QCP) - Quality Certification Program Current Edition.
- G. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2018).
- H. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).
- I. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.
- J. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- K. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- L. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- M. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Warranty, executed in Owner's name.

**1.05 QUALITY ASSURANCE**

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- C. Quality Certification:
  1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: [www.awiqcp.org/#sle](http://www.awiqcp.org/#sle).
  2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  3. Provide designated labels on shop drawings as required by certification program.
  4. Provide designated labels on installed products as required by certification program.
  5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

#### **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for 2 years.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  1. Eggers Industries: [www.eggersindustries.com/#sle](http://www.eggersindustries.com/#sle).
  2. Graham Wood Doors: [www.grahamdoors.com/#sle](http://www.grahamdoors.com/#sle).
  3. Marshfield DoorSystems, Inc: [www.marshfielddoors.com/#sle](http://www.marshfielddoors.com/#sle).
  4. Masonite; [www.masonite.com/](http://www.masonite.com/)
  5. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 DOORS**

- A. Doors: Refer to drawings for locations and additional requirements.
  1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Exterior Doors: Flush solid core construction and water repellent treated.
  1. Thickness: 1-3/4 inches (44 mm), unless otherwise indicated.
  2. Facing: Wood veneer with factory opaque finish to match SW - 7048 Urbane Bronze.
- C. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
  1. Provide solid core doors at each location.
  2. Fire Rated Doors: Tested to 90 minutes in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
  3. Wood veneer facing with factory transparent finish as indicated on drawings.
  4. Wood veneer facing with factory opaque finish as indicated on drawings.

#### **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

## **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: Red oak (verify each location), veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical Edges: Same species as face veneer.
  - 2. "Running Match" each pair of doors and doors in close proximity to each other.
- B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.
- C. Facing Adhesive: Type I - waterproof.

## **2.05 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
  - 1. Exception: Doors to be field finished.
- E. Provide edge clearances in accordance with the quality standard specified.

## **2.06 FACTORY FINISHING - WOOD VENEER DOORS**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Stain: As selected by Architect.
    - c. Sheen: Semigloss.
  - 2. Opaque:
    - a. System - 2, Lacquer, Precatalyzed.
    - b. Color: As selected by Architect.
    - c. Sheen: Semigloss.
- B. Seal door top edge with color sealer to match door facing.

## **2.07 ACCESSORIES**

- A. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
  - 2. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  - 3. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
  - 4. Glazing: Single vision units, 1/4 inch (6.4 mm) thick glass.
  - 5. Tint: Clear.
  - 6. Coating: Low-E type, on No. 2 surface.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: As specified in Section 08 71 00.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

**3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
  - 2. Install exterior doors in accordance with ASTM E2112.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.
  - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
  - 2. Trim maximum of 3/4 inch (19 mm) off bottom edges.
  - 3. Trim fire-rated doors in strict compliance with fire rating limitations.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Coordinate installation of glazing.
- G. Install door louvers plumb and level.

**3.03 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

**3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

**3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule appended to this section.

**END OF SECTION**

**SECTION 08 44 13  
GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed curtain wall, with vision glazing and glass, metal, and stone infill panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- F. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications 2018.
- G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- H. ASTM C1184 - Standard Specification for Structural Silicone Sealants 2018, with Editorial Revision.
- I. ASTM C1401 - Standard Guide for Structural Sealant Glazing 2014.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- C. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

**1.05 QUALITY ASSURANCE**

- A. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, self-life, storage conditions, and color.

**PART 2 PRODUCTS**

**2.01 CURTAIN WALL**

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Finish: Class I natural anodized.
    - a. Factory finish surfaces that will be exposed in completed assemblies.
    - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  - 2. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.



3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
1. Design Wind Loads: Comply with the following:
    - a. Positive Design Wind Load: [ ] lbf/sq ft ( [ ] Pa).
    - b. Negative Design Wind Load: [ ] lbf/sq ft ( [ ] Pa).
    - c. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
  2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    - a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
    - b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
    - c. Movement of curtain wall relative to perimeter framing.
    - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 10 psf (480 Pa).

## 2.02 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
- B. Glazing: As specified in Section 08 80 00.
- C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
  1. Face Sheet: [.024] inch ([ ] mm) thick.
  2. Core: Glass fiber insulation core with R-value of [4.19] (RSI-value of [ ]).
  3. Back Sheet: [.024] inch ([ ] mm) thick.
  4. Exterior Finish: Class I color anodized.
  5. Interior Finish: Clear anodized.
    - a. Products:
      - 1) GlazeGuard® 1000 WR+; [www.citadelap.com/products/glazeguard-r-1000-wr](http://www.citadelap.com/products/glazeguard-r-1000-wr)
      - 2) Mapes R- Infill Panel; <https://mapespanels.com/mapes-r/>
      - 3) AmeriClad Laminated Wall Panels; <https://www.americlad.com/laminated-panels>

## 2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- D. Glazing Accessories: As specified in Section 08 80 00.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

**3.02 INSTALLATION**

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

**3.03 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

**3.04 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**

## SECTION 08 71 00 – DOOR HARDWARE

### GENERAL

#### 1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.02 SUMMARY

Section includes:

1. Mechanical and electrified door hardware for:
  - a. Swinging doors.
  - b. Gates.
2. Electronic access control system components, including:
  - a. Electronic access control devices.
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
4. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
4. Division 26 sections for connections to electrical power system and for low-voltage wiring.
5. Division 28 sections for coordination with other components of electronic access control system.

### 1.03 ALTERNATE PRICING

Provide alternate to include the Todd County School District preferred hardware manufacturers and series as indicated below:

1. Locksets: Schlage L9000 series, ND series, KS series padlocks.
2. Panic Exit Devices: VonDuprin 33A/99 series and required power supplies.
3. Door Closers: LCN 4000 series.

### 1.04 REFERENCES

UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

### 1.05 SUBMITTALS

General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

Action Submittals:

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. Wiring Diagrams: For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.

- 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Quantity, type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).  
Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
  - l. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings; after field verifying existing conditions and conducting the "Field Verification Conference." Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
5. Key Schedule:
  - a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
  - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

- f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:
  - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
  - a. UL listings for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
  - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
  - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
4. Warranty: Special warranty specified in this Section.

Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Factory order acknowledgement numbers (for warranty and service)
  - d. Name, address, and phone number of local representative for each manufacturer.
  - e. Parts list for each product.
  - f. Final approved hardware schedule, edited to reflect conditions as-installed.
  - g. Final keying schedule
  - h. Copies of floor plans with keying nomenclature
  - i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
  - j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

## 1.06 QUALITY ASSURANCE

Requirements of Regulatory Agencies:

1. Furnish finish hardware to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.

2. Furnish finish hardware to comply with the requirements of the regulations for public building accommodations for physically handicapped persons of the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. Provide hardware for fire rated openings in compliance with NFPA 80 and state and local building code requirements. Provide only hardware that has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and door frame labels.

Supplier:

1. Mechanical Hardware
  - a. Shall be an established firm dealing in contract builders' hardware. Distributor must have adequate inventory, qualified personnel on staff and be located within 100 miles of the project. The distributor must be a factory-authorized dealer for all materials required. The supplier shall be or have in employment an Architectural Hardware Consultant (AHC).
  - b. Door Hardware distributor/supplier listed on the Bid Form shall be a factory authorized distributor for the hardware specified. This requirement will not be allowed to be met by a non-factory authorized dealer subcontracting to a factory authorized dealer. Any submitted bid that attempts to circumvent this requirement will be considered non-response and will be removed from consideration.
2. Electrified Hardware:
  - a. Shall be an experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials. The supplier must be a factory-authorized distributor for all materials required.
  - b. Shall prepare data for electrified door hardware, including shop drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this project.
  - c. Shall have experience in providing consulting services for electrified door hardware installations.

Installer Qualifications:

1. Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

**Fire-Rated Door Openings:** Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

**Electrified Door Hardware:** Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

**Accessibility Requirements:** For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

#### Field Verification Conference

1. Conduct an onsite door by door verification of existing frame and door conditions to ensure that submitted products will work, following the hardware sets as the design intent.
2. Conduct a meeting with the architect and owner to complete a final verification of how each door will function.
3. Include in submittal any adjustments required based on field verification and meeting with architect or owner noting required changes.

#### Keying Conference

1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
  - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - b. Preliminary key system schematic diagram.
  - c. Requirements for key control system.
  - d. Requirements for access control.
  - e. Address for delivery of keys.

#### Pre-installation Conference

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

#### Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.



### 1.07 DELIVERY, STORAGE, AND HANDLING

Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer's original packaging.

Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

Deliver keys to Owner by registered mail or overnight package service.

### 1.08 COORDINATION

Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

Security: Coordinate installation of door hardware, access control, and keying with Owner's security consultant.

Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

### 1.09 WARRANTY

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. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.
  - a. Closers:
    - 1) Mechanical: 30 years.
  - b. Automatic Operators: 2 years.
  - c. Exit Devices:
    - 1) Mechanical: 3 years.
    - 2) Electrified: 1 year.
  - d. Locksets:
    - 1) Mechanical: 3 years
    - 2) Electrified: 1 year.
  - e. Continuous Hinges: Lifetime warranty.
  - f. Key Blanks: Lifetime
2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

#### 1.10 MAINTENANCE

Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

#### PRODUCTS

##### 2.01 MANUFACTURERS

The Owner requires use of certain products for their unique characteristics and project suitability to insure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "Todd County School District Standard."

1. Where "Todd County School District Standard" is noted, submittals and substitution requests for other products will not be considered.

Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

## 2.02 MATERIALS

### Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

Cable and Connectors: Hardwired Electronic Access Control Lockset and Exit Device Trim:

1. Data: 24AWG, 4 conductor shielded, Belden 9843, 9841 or comparable.
2. DC Power: 18 AWG, 2 conductor, Belden 8760 or comparable.
3. Provide type of data and DC power cabling required by access control device manufacturer for this installation.
4. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

## 2.03 HINGES

Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series.
2. Acceptable Manufacturers and Products: Hager BB series (ECBB series not approved), Bommer BB5000.

Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches(914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches(114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches(114 mm) high
3. 1-3/4 inch(44 mm) thick doors over 36 inches(914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches(127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches(127 mm) high
4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches(127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches(127 mm) high
5. Provide three hinges per door leaf for doors 90 inches(2286 mm) or less in height, and one additional hinge for each 30 inches(762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins:Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges:Steel pins
  - b. Non-Ferrous Hinges:Stainless steel pins
  - c. Out-Swinging Exterior Doors:Non-removable pins
  - d. Out-Swinging Interior Lockable Doors:Non-removable pins
  - e. Interior Non-lockable Doors:Non-rising pins
8. Width of hinges: 4-1/2 inches(114 mm) at 1-3/4 inch(44 mm) thick doors, and 5 inches(127 mm) at 2 inches(51 mm) or thicker doors.Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.

## 2.04 CONTINUOUS HINGES

### Aluminum Geared

1. Manufacturers:
  - a. Scheduled Manufacturer: Ives.
  - b. Acceptable Manufacturers: Pemko, Select.
2. Requirements:
  - a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
  - b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
  - c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.

- d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges 1 inch(25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

## 2.05 ELECTRIC POWER TRANSFER

### Manufacturers:

- a. Scheduled Manufacturer: Von Duprin EPT-10.
- b. Acceptable Manufacturers: Precision EPT12C, Securitron CEPT-10.

Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.06 DOOR CORDS

### Manufacturers:

1. Scheduled Manufacturer: Schlage 788/798 Series
2. Acceptable Manufacturers: Securitron, Locknetics

### Requirements:

1. Provide door cords with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.07 FLUSH BOLTS

### Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

### Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch(305 mm) steel or brass rods at doors up to 90 inches(2286 mm) in height. For doors over 90 inches(2286 mm) in height increase top rods by 6 inches(152

mm) for each additional 6 inches(152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

## 2.08 MORTISE LOCKS

### Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series.
2. Acceptable Manufacturers and Products: Best 35H series, Corbin-Russwin ML2000 series.
3. See Alternate Pricing for Todd County School District Standard.

### Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3 hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2 inch x 1/2 inch with 180 degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
  - a. Inside Security Indicator: Provide indicator above cylinder or thumbturn for visibility during lockdown that identifies the outside trim as locked/unlocked status of the door.
  - b. Outside Status Indicator: Provide indicator above cylinder for visibility that identifies the outside trim as locked/unlocked status of the door.
  - c. Outside Occupancy Indicator: Provide indicator above cylinder or emergency release for visibility while operating the lock that identifies an occupied/unoccupied status of the lock or latch.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Verify lock functions with owner prior to ordering.
6. Provide locks with standard 2-3/4 inches(70 mm) backset with full 3/4 inch(19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch(25 mm) throw, constructed of stainless steel.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
9. Provide motor based electrified locksets with electrified options as scheduled in the hardware sets and comply with the following requirements:
  - a. Universal input voltage – single chassis accepts 12 or 24V DC to allow for changes in the field without changing lock chassis.
  - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
  - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
  - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
  - e. Connections – provide quick-connect Molex system standard.
10. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

- a. Lever Design: Schlage 06
- b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.09 CYLINDRICAL LOCKS – GRADE 1

### Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND series
2. Acceptable Manufacturers and Products: Sargent 11-Line, Corbin-Russwin CL3100 series
3. See Alternate Pricing for Todd County School District Standard.

### Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Verify lock functions with owner prior to ordering.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
  - a. Lever Design: SchlageRHO
  - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.10 PADLOCKS:

### Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage KS Series
2. Scheduled Manufacturers and Products: Best 11B Series, Sargent 758 Series
3. See Alternate Pricing for Todd County School District Standard.

### Requirements:

1. Provide padlocks with 1-inch(25 mm) shackle height, unless noted otherwise, as specified.
2. Cylinders: Refer to “KEYING” article, herein.

## 2.11 AUXILIARY LOCKS

### Deadlocks:

1. Manufacturers and Products:
  - a. Scheduled Manufacturer and Product: Schlage L400 series.
  - b. Acceptable Manufacturers and Products: Best 38H series, Sargent 4870 series.

2. Requirements:

- a. Provide mortise deadlock series conforming to ANSI/BHMA A156 and function as specified.
- b. Cylinders: Refer to "KEYING" article, herein.
- c. Provide deadlocks with standard 2-3/4 inches(70 mm) backset. Provide deadbolt with full 1 inch(25 mm) throw, constructed of stainless steel.
- d. Provide manufacturer's standard strike.

Deadbolts:

1. Manufacturers and Products:

- a. Scheduled Manufacturer and Product: Schlage B600 Series.
- b. Acceptable Manufacturers and Products: Best 8T3 Series, Corbin-Russwin DL3000 Series, Falcon D100 Series.

2. Requirements:

- a. Provide deadbolt series conforming to ANSI/BHMA A156 and function as specified.
- b. Cylinders: Refer to "KEYING" article, herein.
- c. Provide deadbolts with standard 2-3/4 inches(70 mm) backset. Provide 2-3/8 inches(60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1 inch(25 mm) throw, constructed of steel alloy.
- d. Provide manufacturer's standard strike.

## 2.12 EXIT DEVICES

Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99/33A series.
2. Acceptable Manufacturers and Products: Sargent 19-43-GL-80 series, Precision Apex series.
3. See Alternate Pricing for Todd County School District Standard.

Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Verify exit device functions with owner prior to ordering.
4. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
5. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
6. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Provide dogging indicators (CDSI/HDSI) for visible indication of dogging status.



13. Removable Mullions: 2 inches(51 mm) x 3 inches(76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.
16. Concealed Vertical Cable Exit Devices: provide cable-actuated concealed vertical latch system in two-point for non-rated or fire rated wood doors up to a 90 minute rating and less bottom latch (LBL) configuration for non-rated or fire rated wood doors up to 20 minute rating. Vertical rods not permitted.
  - a. Cable: Stainless steel with abrasive resistant coating. Conduit and core wire ends snap into latch and center slides without use of tools.
  - b. Wood Door Prep: Maximum 1 inch x 1.1875 inch x 3.875 inches top latch pocket and 1 inch x 1.1875 inch x 5 inches bottom latch pocket which does not require the use of a metal wrap or edge for non-rated or fire rated wood doors up to a 45 minute rating.
  - c. Latchbolts and Blocking Cams: Manufactured from sintered metal low carbon copper-infiltrated steel, with molybdenum disulfide low friction coating.
  - d. Top Latchbolt: Minimum 0.38 inch(10 mm) and greater than 90degree engagement with strike to prevent door and frame separation under high static load.
  - e. Bottom Latchbolt: Minimum of 0.44 inch(11 mm) engagement with strike.
  - f. Product Cycle Life: 1,000,000 cycles.
  - g. Latch Operation: Top and bottom latch operate independently of each other. Top latch fully engages top strike even when bottom latch is compromised. Separate trigger mechanisms not permitted.
  - h. Latch release does not require separate trigger mechanism.
  - i. Cable and latching system characteristics:
    - 1) Installed independently of exit device installation, and capable of functioning on door prior to device and trim installation.
    - 2) Connected to exit device at single point in steel and aluminum doors, and two points for top and bottom latches in wood doors.
    - 3) Bottom latch height adjusted, from single point for steel and aluminum doors and two points for wood doors, after system is installed and connected to exit device, while door is hanging
    - 4) Bottom latch position altered up and down minimum of 2 inches(51 mm) in steel and aluminum doors without additional adjustment. Bottom latch deadlocks in every adjustment position in wood doors.
    - 5) Top and bottom latches in steel and aluminum doors and top latch in wood doors may be removed while door is hanging.
17. Top latch mounting: double or single tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
18. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
  - a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.13 ELECTRIC STRIKES

### Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 6000 Series.

2. Acceptable Manufacturers and Products: Folger Adam 300 Series, HES 1006 Series.

Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

## 2.14 POWER SUPPLIES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Precision ELR series, Securitron BPS series
3. See Alternate Pricing for Todd County School District Standard.

### B. Requirements:

1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
2. Provide appropriate quantity and size of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide appropriate option boards for power supplies necessary for proper operation of the electrified locking components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component used in the system.
4. Provide regulated and filtered 24 VDC power supply and UL class 2 listed.
5. Options:
  - a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
  - b. Provide sealed batteries for battery back-up at each power supply where specified.
  - c. Provide keyed power supply cabinet.
6. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
7. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.

## 2.15 CYLINDERS

### Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: None. Todd County School District Standard.

### Requirements:

1. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
  - a. Cylinder/Core Type: Large Format or Full Size Interchangeable Core (LFIC/FSIC).
  - b. Keyway/Security Type: Restricted/Patented
3. Nickel silver bottom pins.

Construction Keying:

1. Replaceable Construction Cores
  - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements. See miscellaneous hardware set.
    - 1) 3 construction control keys
    - 2) 20 construction change (day) keys.
    - 3) 60 construction keyed cores.
  - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

## 2.16 KEYING

Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

1. Todd County School District requires the provider be a Schlage factory authorized direct dealer to protect the integrity and security of their key system.

Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
  - a. Master Keying system as directed by the Owner.
2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
  - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - b. Patent Protection: Keys and blanks protected by one or more utility patent(s): until the year, 2029.
  - c. Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
4. Identification:
  - a. Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
  - b. Identification stamping provisions must be approved by the Architect and Owner.

- c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
  - d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
  - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
- a. Change (Day) Keys: 3 per cylinder/core.
  - b. Permanent Control Keys: 3.
  - c. Master Keys: 6.

## 2.17 KEY CONTROL SYSTEM

### Manufacturers:

1. Scheduled Manufacturer: Telkee.
2. Acceptable Manufacturers: HPC, Lund.

### Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
  - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
  - b. Provide hinged-panel type cabinet for wall mounting.

## 2.18 DOOR CLOSERS

### Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4040XP series.
2. Acceptable Manufacturers and Products: Norton 9500 series, Sargent 281 series.
3. See Alternate Pricing for Todd County School District Standard.

### Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch(38 mm) diameter with 3/4 inch(19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.19 DOOR TRIM

### Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

### Requirements:

1. Provide push plates 4 inches(102 mm) wide by 16 inches(406 mm) high by 0.050 inch(1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches(102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches(102 mm) wide by 16 inches(406 mm) high by 0.050 inch(1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches(102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

## 2.20 PROTECTION PLATES

### Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

### Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch(1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  - a. Kick Plates: 10 inches(254 mm) high by 2 inches(51 mm) less width of door on single doors, 1 inch(25 mm) less width of door on pairs

- b. Mop Plates: 4 inches(102 mm) high by 2 inches(51 mm) less width of door on single doors, 1 inch(25 mm) less width of door on pairs
- c. Armor Plates: 36 inches(914 mm) high by 2 inches(51 mm) less width of door on single doors, 1 inch(25 mm) less width of door on pairs

## 2.21 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

### Manufacturers:

- 1. Scheduled Manufacturers: Glynn-Johnson.
- 2. Acceptable Manufacturers: Hiawatha, Sargent.

### Requirements:

- 1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
- 2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
- 3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
- 4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

## 2.22 DOOR STOPS AND HOLDERS

### Manufacturers:

- 1. Scheduled Manufacturer: Ives.
- 2. Acceptable Manufacturers: Rockwood, Trimco.

### Provide door stops at each door leaf:

- 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
- 2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
- 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.23 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

### Manufacturers:

- 1. Scheduled Manufacturer: Zero International.
- 2. Acceptable Manufacturers: National Guard, Reese.

### Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
  - a. Saddle Thresholds: 1/2 inch(13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: 1/2 inch(13 mm) high by 5 inches(127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.24 SILENCERS

### Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Rockwood, Trimco.

### Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches(762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.25 MAGNETIC HOLDERS

### Manufacturers:

1. Scheduled Manufacturer: LCN.
2. Acceptable Manufacturers: Rixson, Sargent.

### Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

## 2.26 FINISHES

Provide finish for each item as indicated in the sets.

## EXECUTION

### 3.01 EXAMINATION

Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
  - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
  - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
  - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### 3.03 INSTALLATION

Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.



Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.

Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect's opening number.

Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

Power Supplies:

1. Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
2. At contractor's discretion power supplies and option boards can be combined to power multiple doors in localized areas of a building.

Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

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.

### 3.04 FIELD QUALITY CONTROL

Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. 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.

### 3.05 FIELD INSPECTIONS:

Fire Door Assembly Inspection and Testing: Provide functional testing and inspection of fire door assemblies in accordance with NFPA 80-2007/2010. Inspections shall be performed by individuals certified by Intertek as a Fire Door Assembly Inspector, using reporting forms provided by the Door and Hardware Institute (DHI). Alternatively, inspections may be performed by individuals acceptable to the Architect, who have knowledge and understanding of the operating components of the applicable door type, and who have experience in preparing written reports of testing and inspection results.

1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
2. Submit a signed, written final report as specified in Paragraph 1.4: Submittals.
3. Contractor shall correct all deficiencies and schedule a reinspection of fire door assemblies which were noted as deficient on the inspection report.
4. Inspector shall reinspect fire door assemblies after repairs are made.
5. Additional reinspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.

### 3.06 ADJUSTING

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. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

### 3.07 CLEANING AND PROTECTION

Clean adjacent surfaces soiled by door hardware installation.

Clean operating items as necessary to restore proper function and finish.

Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.08 DEMONSTRATION

Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.09 DOOR HARDWARE SCHEDULE

Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

Hardware Sets:

NORTH TODD ELEMENTARY SCHOOL

**HARDWARE GROUP NO. NES-01**

FOR USE ON DOOR #(S):

EX2                      EX10

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY	628	IVE
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	ELEC PANIC HARDWARE	CD-RX-99-DT	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH ST-1595	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
1	EA	MULLION SEAL	8780NBK	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND CONFIRM EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-02**

FOR USE ON DOOR #(S):

C4

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PANIC HARDWARE	LD-99-DT	626	VON
1	EA	WALL STOP/HOLDER	WS40	626	IVE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-03**

FOR USE ON DOOR #(S):  
601

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	CDSI-9927-DT-LBR	626	VON
1	EA	PANIC HARDWARE	CDSI-9927-NL-LBR	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
3	EA	FSIC CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-04**

FOR USE ON DOOR #(S):  
900

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	ENTRANCE LOCK	ALX53J RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-05**

FOR USE ON DOOR #(S):

401F	401G	502	FA2	GS3	J1
J2	M2	M3	M4	M5	M6
M7	P3A	ST3			

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. NES-06**

FOR USE ON DOOR #(S):

301	506A	510	BR1	C2	C3
C5	C7	C8	C9	FA1	L1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. NES-07**

FOR USE ON DOOR #(S):

EX6	EX7
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PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		
	EA	NOTE	SALVAGE AND RE-USE EXISTING ND75 LOCK FROM CLASSROOM		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.

**HARDWARE GROUP NO. NES-08**

FOR USE ON DOOR #(S):

S1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. NES-09**

FOR USE ON DOOR #(S):

EX15                GS2

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

**HARDWARE GROUP NO. NES-10**

FOR USE ON DOOR #(S):

M1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-11**

FOR USE ON DOOR #(S):

101	102	103	104	105	106
107	108	109	110	111	201
202	203	204	205	206	207
208	209	210	211	212	213
214	302	303	304	305	306
307	308	309	310	311	401A
401B	401C	401E	502A	503	504
504A	505	506	507	507A	511
601B	701	701A	702	702A	C6
DS1	O1	P1	P1B	P2	P2B
P3C	P3E	P4	P4B	TR1	TR2

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-12**

FOR USE ON DOOR #(S):

P3

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	FILLER PLATE	BF 161		DON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.



**HARDWARE GROUP NO. NES-13**

FOR USE ON DOOR #(S):  
P3F

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-14**

FOR USE ON DOOR #(S):  
GS1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-15**

FOR USE ON DOOR #(S):

P1C                      P2C                      P3D                      P4C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT MONITORS DOOR POSITION.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-16**

FOR USE ON DOOR #(S):

601A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	CONST LATCHING BOLT	FB51T/FB61T AS REQ'D	630	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	COORDINATOR	COR X FL (MB AS REQ'D)	628	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-17**

FOR USE ON DOOR #(S):

901                      902                      903                      GATE2                      GATE3                      GATE

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PRIMUS RIM CYLINDER	20-757	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. NES-18**

FOR USE ON DOOR #(S):

EX3                      EX5                      EX8                      EX9                      EX12                      EX13  
EX16

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
2	EA	NL DRIVE SCREW	090074 (AS REQ'D TO CONVERT LEVER TRIM TO NIGHT LATCH FUNCTION)		VON
2	EA	QEL KIT	958003		VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*

**HARDWARE GROUP NO. NES-19**

FOR USE ON DOOR #(S):

EX1                      EX11

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY	628	IVE
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH ST-1595	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
1	EA	MULLION SEAL	8780NBK	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND CONFIRM EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-20**

FOR USE ON DOOR #(S):

EX14                      EX15

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	NL DRIVE SCREW	090074 (AS REQ'D TO CONVERT LEVER TRIM TO NIGHT LATCH FUNCTION)		VON
1	EA	QEL KIT	958003		VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*

**HARDWARE GROUP NO. NES-21**

FOR USE ON DOOR #(S):

C1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP/HOLDER	WS40	626	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. NES-22**

FOR USE ON DOOR #(S):

EX4

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*

**HARDWARE GROUP NO. NES-23**

FOR USE ON DOOR #(S):

401                      401D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. NES-24**

FOR USE ON DOOR #(S):

201A	204A	205A	206A	207A	208A
209A	210A	211A	212A	213A	214A
303A	303B	508	509	512	513
600	B1	B2	BR2	F1	G1
G2	P1A	P2A	P3B	P4A	R1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. NES-25**

FOR USE ON DOOR #(S):

B3

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		



SOUTH TODD ELEMENTARY SCHOOL

**HARDWARE GROUP NO. SES-01**

FOR USE ON DOOR #(S):

C4

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PANIC HARDWARE	LD-99-DT	626	VON
1	EA	WALL STOP/HOLDER	WS40	626	IVE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-02**

FOR USE ON DOOR #(S):

601

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	CDSI-9927-DT-LBR	626	VON
1	EA	PANIC HARDWARE	CDSI-9927-NL-LBR	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
3	EA	FSIC CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-03**

FOR USE ON DOOR #(S):

900

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	ENTRANCE LOCK	ALX53J RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-04**

FOR USE ON DOOR #(S):

401F	401G	502	FA2	GS3	J1
J2	ST1	ST2	ST4	ST5	ST6

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. SES-05**

FOR USE ON DOOR #(S):

301	B1	C2	C3	C5	C7
C8	C9	L1			

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. SES-06**

FOR USE ON DOOR #(S):

6                      7

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		
	EA	NOTE	SALVAGE AND RE-USE EXISTING ND75 LOCK FROM CLASSROOM		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.

**HARDWARE GROUP NO. SES-07**

FOR USE ON DOOR #(S):

B1                      GS2

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

**HARDWARE GROUP NO. SES-08**

FOR USE ON DOOR #(S):

2                      10

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.

**HARDWARE GROUP NO. SES-09**

FOR USE ON DOOR #(S):

1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.

**HARDWARE GROUP NO. SES-10**

FOR USE ON DOOR #(S):

701C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-11**

FOR USE ON DOOR #(S):

101	102	103	104	105	106
107	108	109	110	111	201
202	203	204	205	206	207
208	209	210	211	212	213
214	302	303	304	305	306
307	308	309	310	311	401A
401B	401C	401E	501	502A	504
504A	505	506	506A	507	507A
508	510	601B	701	701A	702
702A	C6	DS1	FA1	O1	P1
P1B	P2	P2B	P3A	P3C	P3E
P4	P4B	ST3	ST7	TR1	TR2

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-12**

FOR USE ON DOOR #(S):

P3

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	FILLER PLATE	BF 161		DON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-13**

FOR USE ON DOOR #(S):  
P3F

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	LOCK GUARD	LG10	630	IVE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. SES-14**

FOR USE ON DOOR #(S):  
GS1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. SES-15**

FOR USE ON DOOR #(S):

P1C                      P2C                      P3D                      P4C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT MONITORS DOOR POSITION.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. SES-16**

FOR USE ON DOOR #(S):

601A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. SES-17**

FOR USE ON DOOR #(S):

901                      902                      GATE2                      GATE3                      GATE

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PRIMUS RIM CYLINDER	20-757	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. SES-18**

FOR USE ON DOOR #(S):

3                      11                      12

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*



**HARDWARE GROUP NO. SES-19**

FOR USE ON DOOR #(S):

14                      15

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*

**HARDWARE GROUP NO. SES-20**

FOR USE ON DOOR #(S):

C1

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP/HOLDER	WS40	626	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. SES-21**

FOR USE ON DOOR #(S):

4                      5                      8                      9                      13                      16

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
2	EA	NL DRIVE SCREW	090074 (AS REQ'D TO CONVERT LEVER TRIM TO NIGHT LATCH FUNCTION)		VON
2	EA	QEL KIT	958003		VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

*CHECK THAT DOOR ENGAGES PROPERLY WITH CATCH AND CHECK THAT CLOSER FUNCTIONS PROPERLY.*

**HARDWARE GROUP NO. SES-22**

FOR USE ON DOOR #(S):

401                      401D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

NOTE: VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. SES-23**

FOR USE ON DOOR #(S):

165	203	206A	207A	208A	209A
210A	211A	212A	213A	214A	303A
512	514	B1	B2	B2	F1
G1	G2	P1A	P2A	P3B	P4A
R1					

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. SES-24**

FOR USE ON DOOR #(S):

B2

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. SES-25**

*FOR USE ON DOOR #(S):*  
503

*PROVIDE EACH OPENING WITH THE FOLLOWING:*

<b><u>QTY</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>CATALOG NUMBER</u></b>	<b><u>FINISH</u></b>	<b><u>MFR</u></b>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

TODD COUNTY MIDDLE SCHOOL

**HARDWARE GROUP NO. MS-01**

FOR USE ON DOOR #(S):

116A                      126

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9927-L-F-LBR-06-499F	626	VON
2	EA	RIM HOUSING	20-079	626	SCH
2	EA	FSIC CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	1461 SCUSH STD	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7800 SERIES AS REQ'D	689	LCN
1	EA	MEETING STILE	328AA-S	AA	ZER
1	EA	GASKETING	488SCL PSA	CL	ZER

DOORS MAGNETICALLY HELD OPEN. DOORS WILL CLOSE AND LATCH UPON FIRE ALARM OR POWER LOSS. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND CONFIRM EXISTING HINGE PREP SIZE AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-02**

FOR USE ON DOOR #(S):

311                      320                      325

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DUMMY PUSH BAR	330-DT-990	626	VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-03**

FOR USE ON DOOR #(S):

201                      237

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	CDSI-RX-99-DT	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-04**

FOR USE ON DOOR #(S):

102

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
1	EA	CYLINDER	RIM CYLINDER AS REQ'D	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-05**

FOR USE ON DOOR #(S):

209                      210

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PASSAGE SET	L9010 06N	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-06**

FOR USE ON DOOR #(S):  
215

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIVACY LOCK	L9040 06N L583-363 L283-722	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-07**

FOR USE ON DOOR #(S):  
223

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	OFFICE/ENTRY LOCK	L9050J 06N L583-363	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-08**

FOR USE ON DOOR #(S):  
221                      225                      231                      233

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM LOCK	L9070J 06N	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-09**

FOR USE ON DOOR #(S):

204                      222

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	L9080J 06N	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-10**

FOR USE ON DOOR #(S):

219

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	L9080J 06N	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-11**

FOR USE ON DOOR #(S):

226                      227

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM DEAD LOCK	L463J	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.



**HARDWARE GROUP NO. MS-12**

FOR USE ON DOOR #(S):

214                      217                      220                      229                      230

PROVIDE EACH OPENING WITH THE FOLLOWING:

<b><u>QTY</u></b>		<b><u>DESCRIPTION</u></b>	<b><u>CATALOG NUMBER</u></b>	<b><u>FINISH</u></b>	<b><u>MFR</u></b>
1	EA	STOREROOM MORT LOCK W/LED INDICATOR	LEBMS-ADDJ-06 [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-13**

FOR USE ON DOOR #(S):

205

PROVIDE EACH OPENING WITH THE FOLLOWING:

<b><u>QTY</u></b>		<b><u>DESCRIPTION</u></b>	<b><u>CATALOG NUMBER</u></b>	<b><u>FINISH</u></b>	<b><u>MFR</u></b>
1	EA	STOREROOM MORT LOCK W/LED INDICATOR	LEBMS-ADDJ-06 [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP H	689	LCN
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-14**

FOR USE ON DOOR #(S):

224                      232

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM MORT LOCK W/LED INDICATOR	LEBMS-ADDJ-06 [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-15**

FOR USE ON DOOR #(S):

213

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM MORT LOCK W/LED INDICATOR	LEBMS-ADDJ-06 [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-16**

FOR USE ON DOOR #(S):

140

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PASSAGE SET	ND10S RHO	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-17**

FOR USE ON DOOR #(S):

135                      136                      301

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-18**

FOR USE ON DOOR #(S):

005                      107

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-19**

FOR USE ON DOOR #(S):

003                      006

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-20**

FOR USE ON DOOR #(S):

110	111	112	113	114	115
117	118	119	120	121	122
123	124	133	137	300	302
307	308	309	310	312	313
314	315	316	317	318	319
322	323	324	329	330	

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-21**

FOR USE ON DOOR #(S):

216

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP HCUSH ST-1595	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	VIEWER	U698	626	IVE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND CONFIRM EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-22**

FOR USE ON DOOR #(S):  
139

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
3	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
4	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

NOTE: PADLOCK(S) FOR CABINETS IN ROOM.

**HARDWARE GROUP NO. MS-23**

FOR USE ON DOOR #(S):  
127

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-24**

FOR USE ON DOOR #(S):

001                      002                      004

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-25**

FOR USE ON DOOR #(S):

327

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-26**

FOR USE ON DOOR #(S):

206                      207                      208

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM LOCK	L9070J 06N	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP H	689	LCN
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-27**

FOR USE ON DOOR #(S):

103                      104                      128                      129                      130                      131  
132                      134                      138                      328                      331                      332  
333

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-28**

FOR USE ON DOOR #(S):

234                      235

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PANIC HARDWARE	CDSI-99-DT	626	VON
1	EA	PANIC HARDWARE	CDSI-99-NL	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. MS-29**

FOR USE ON DOOR #(S):

216A                      CHILLER  
                                    FENCE

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		



**HARDWARE GROUP NO. MS-30**

FOR USE ON DOOR #(S):  
101

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-33A-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-33A-NL 24 VDC	626	VON
2	EA	SHIM KIT	33A-GBK-R	689	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		
	EA	NOTE	RE-USE EXISTING MULLION		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-31**

FOR USE ON DOOR #(S):

203                      218                      334

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-32**

FOR USE ON DOOR #(S):

202                      236

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP HCUSH TBWMS	689	LCN
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-33**

FOR USE ON DOOR #(S):

200                      238

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-34**

FOR USE ON DOOR #(S):

42                      228                      321                      326

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. MS-35**

*FOR USE ON DOOR #(S):*

105	106	108	109	211	212
303	304	305	306		

*PROVIDE EACH OPENING WITH THE FOLLOWING:*

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. MS-36**

*FOR USE ON DOOR #(S):*

116	125
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*PROVIDE EACH OPENING WITH THE FOLLOWING:*

<u>QTY</u>	<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

TODD COUNTY CENTRAL HIGH SCHOOL

**HARDWARE GROUP NO. HS-01**

FOR USE ON DOOR #(S):

300                      306

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
2	EA	FIRE EXIT HARDWARE	99-L-BE-F-06	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK	BK	ZER
	EA	NOTE	RE-USE EXISTING MAGNETIC HOLD OPENS		

NOTE: RE-USE EXISTING WALL MAGNETIC HOLD OPENS. DOORS CLOSE AND LATCH UPON SOUND OF FIRE ALARM OR LOSS OF POWER. ALWAYS FREE EGRESS.

**HARDWARE GROUP NO. HS-02**

FOR USE ON DOOR #(S):

1B                      1C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	CDSI-RX-99-DT	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
3	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1			WEATHERSTRIP BY DOOR/FRAME SUPPLIER		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	DOOR CONTACT	7764 [COORDINATE WITH DIV. 28]	628	SCE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-03**

FOR USE ON DOOR #(S):  
23B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	DUMMY PUSH BAR	330DT-DT	626	VON
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-04**

FOR USE ON DOOR #(S):  
411A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-9927-DT-LBR 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9927-NL-LBR 24 VDC	626	VON
2	EA	RIM HOUSING	20-079	626	SCH
2	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES. VERIFY EXISTING CLOERS FUNCTION PROPERLY.

**HARDWARE GROUP NO. HS-05**

FOR USE ON DOOR #(S):  
208A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	PANIC HARDWARE	LD-9927-DT-LBR	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
2	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	WALL STOP/HOLDER	WS40	626	IVE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-06**

FOR USE ON DOOR #(S):  
217A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	PANIC HARDWARE	9927-L-LBR-06	626	VON
2	EA	RIM HOUSING	20-079	626	SCH
2	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-07**

FOR USE ON DOOR #(S):  
406

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH ST-1595	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-NH-A	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*



**HARDWARE GROUP NO. HS-08**

FOR USE ON DOOR #(S):

112A                      112H

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	CDSI-9949-DT	626	VON
1	EA	PANIC HARDWARE	CDSI-9949-NL	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
3	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-NH-A	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-09**

FOR USE ON DOOR #(S):

112B                      112C                      112D                      112E

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	PANIC HARDWARE	CDSI-9949-DT	626	VON
2	EA	MORTISE CYLINDER	20-059 X K510-730 XQ11-948	626	SCH
2	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-NH-A	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-10**

FOR USE ON DOOR #(S):  
121B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ALX80J RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-11**

FOR USE ON DOOR #(S):  
308                      310

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM DEADBOLT	B663J	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-12**

FOR USE ON DOOR #(S):

1D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
2	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	MULLION SEAL	8780NBK	BK	ZER
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	PUSH BUTTON	621RD 12/24 VDC	630	SCE
2	EA	DOOR CONTACT	7764 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL AT CARD READER OR PUSH BUTTON AT RECEPTION DESK MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.

**HARDWARE GROUP NO. HS-13**

FOR USE ON DOOR #(S):

405B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-9927-DT-LBR 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9927-NL-LBR 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES. VERIFY EXISTING CLOSERS FUNCTION PROPERLY.

**HARDWARE GROUP NO. HS-14**

FOR USE ON DOOR #(S):  
314H

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	MORTISE/RIM CYLINDER AS REQ'D	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-15**

FOR USE ON DOOR #(S):  
7B                      8A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	MORTISE/RIM CYLINDER AS REQ'D	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE	630	VON
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

*OPERATIONAL DESCRIPTON: VALID CREDENTIAL MOMENTARILY RELEASES ELECTRIC STRIKE ALLOWING ENTRANCE. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-16**

FOR USE ON DOOR #(S):  
112F                      112G

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	MORTISE CYLINDER AS REQ'D	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-17**

FOR USE ON DOOR #(S):

097B                      209B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	CYLINDER	MORTISE CYLINDER AS REQ'D	626	SCH
3	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-18**

FOR USE ON DOOR #(S):

7A                              8B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	MORTISE/RIM CYLINDER AS REQ'D	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-19**

FOR USE ON DOOR #(S):

219B                      405A                      902

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	RIM CYLINDER AS REQ'D	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-20**

FOR USE ON DOOR #(S):

18

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	RIM CYLINDER AS REQ'D	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

**HARDWARE GROUP NO. HS-21**

FOR USE ON DOOR #(S):

14                      15                      19                      24

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CYLINDER	RIM CYLINDER AS REQ'D	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR CONTACT TO MONITOR DOOR POSITION.

**HARDWARE GROUP NO. HS-22**

FOR USE ON DOOR #(S):

123A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-23**

FOR USE ON DOOR #(S):  
112J

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-24**

FOR USE ON DOOR #(S):  
304D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-25**

FOR USE ON DOOR #(S):  
093B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-26**

FOR USE ON DOOR #(S):

119B                    119D                    312                    314B                    316

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	ENTRANCE/OFFICE LOCK	ND50JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-27**

FOR USE ON DOOR #(S):

89

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-28**

FOR USE ON DOOR #(S):

119C                    121A                    123B                    210A                    210B                    210D  
212A                    212C                    214                    218                    219A                    314E

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.



**HARDWARE GROUP NO. HS-29**

FOR USE ON DOOR #(S):

123C                      215C                      410

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-30**

FOR USE ON DOOR #(S):

208C                      210E

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-31**

FOR USE ON DOOR #(S):

94                      097A                      209A                      212D                      215B                      226D  
309B                      401A                      421

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-32**

FOR USE ON DOOR #(S):

6

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-33**

FOR USE ON DOOR #(S):

213                      217B                      309A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-34**

FOR USE ON DOOR #(S):

3

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-35**

FOR USE ON DOOR #(S):

23C	23D	23E	085B	085C	085D
085E	085F	087A	087B	090D	092A
096A	096B	096C	98	100	101
102	103	104	105	106	107
108	109	110A	110B	110C	111
116	118	119A	200A	200B	201A
201B	201C	202A	203A	203B	204A
204B	204C	205A	205B	205D	206A
206B	206C	210C	212B	212E	215A
220	221	222A	222B	224A	224B
228B	228D	301A	301B	301C	302
303	304C	305A	305B	305C	307A
307B	314C	314G	404B	407A	407B
408A	408B	419	420	422A	422B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-36**

FOR USE ON DOOR #(S):  
409B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-37**

FOR USE ON DOOR #(S):  
119E                      123D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DUTCH DOOR BOLT	054	626	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-38**

FOR USE ON DOOR #(S):  
304A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-39**

FOR USE ON DOOR #(S):  
409A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-40**

FOR USE ON DOOR #(S):  
091D

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-41**

FOR USE ON DOOR #(S):  
17

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	NDE SPACER	XN12-012 626	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE
1		WEATHERSTRIP BY DOOR/FRAME SUPPLIER			
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-42**

FOR USE ON DOOR #(S):

16

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	NDE SPACER	XN12-012 626	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1		WEATHERSTRIP BY DOOR/FRAME SUPPLIER			
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-43**

FOR USE ON DOOR #(S):

090A                      113B                      223                      228C                      413B                      415B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-44**

FOR USE ON DOOR #(S):

225                      226C                      304E

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-45**

FOR USE ON DOOR #(S):

112I                      115B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED AND EXISTING HINGE PREP SIZES AND LOCATIONS. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*



**HARDWARE GROUP NO. HS-46**

FOR USE ON DOOR #(S):

113A            114                    115A            117                    226A            227  
304B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-47**

FOR USE ON DOOR #(S):

228A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-48**

FOR USE ON DOOR #(S):

091C                      093A                      401                      402B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-49**

FOR USE ON DOOR #(S):

205C

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
2	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-50**

FOR USE ON DOOR #(S):

093C                      226B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-51**

FOR USE ON DOOR #(S):

091A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XPT BUMP	689	LCN
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-52**

FOR USE ON DOOR #(S):

3B                      123E                      E01                      E02

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PRIMUS RIM CYLINDER	20-757	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-53**

FOR USE ON DOOR #(S):

11                      13                      402A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	PADLOCK L/CYL-FSIC	KS43F3200 [FIELD VERIFY REQUIRED SIZE]	606	SCH
1	EA	PRIMUS RIM CYLINDER	20-757	626	SCH

**HARDWARE GROUP NO. HS-54**

FOR USE ON DOOR #(S):

314A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL  
MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT  
STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS  
NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-55**

FOR USE ON DOOR #(S):

1A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	CONT. HINGE	112XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	MORTISE CYLINDER	20-059 X K510-730	626	SCH
1	EA	RIM HOUSING	20-079	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1			WEATHERSTRIP BY DOOR/FRAME SUPPLIER		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	INTERCOM	BY DIV. 28		
2	EA	DOOR CONTACT	7764 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON

*OPERATION: DOOR NORMALLY CLOSED AND LOCKED. DOORS CAN BE LEFT UNLOCKED AS PROGRAMMED BY ACCESS CONTROL.*

*WHEN LOCKED: VALID CREDENTIAL OR AI PHONE MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.*

**HARDWARE GROUP NO. HS-56**

FOR USE ON DOOR #(S):  
404A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

OPERATION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-57**

FOR USE ON DOOR #(S):  
413A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

OPERATION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-58**

FOR USE ON DOOR #(S):  
411B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC FIRE EXIT HARDWARE	QEL-99-NL-F 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

OPERATION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-59**

FOR USE ON DOOR #(S):  
9 12

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS. DOOR CONTACT MONITORS DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-60**

FOR USE ON DOOR #(S):  
085A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-DT 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	WALL STOP/HOLDER	WS40	626	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL  
MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT  
STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS  
NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*



**HARDWARE GROUP NO. HS-61**

FOR USE ON DOOR #(S):

412                      414

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH ST-1595	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-62**

FOR USE ON DOOR #(S):

10                      20                      21                      22                      403                      416A  
416B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-63**

FOR USE ON DOOR #(S):

4                      5

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

*OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. RX SWITCH SHUNTS DOOR CONTACT FOR VALID EGRESS. ALWAYS FREE EGRESS.*

*VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.*

**HARDWARE GROUP NO. HS-64**

FOR USE ON DOOR #(S):

411C                    415A

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-99-NL 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [BY DIV. 28]	LGR	SCE

OPERATION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES AND EXISTING HINGE PREP SIZES AND LOCATIONS. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-65**

FOR USE ON DOOR #(S):

208B

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-9927-DT-LBR 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-9927-NL-LBR 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PERMANENT CORE	23-030 EV29 T	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA	689	LCN
2	EA	WALL STOP/HOLDER	WS40	626	IVE
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-66**

FOR USE ON DOOR #(S):

2                      23A                      25

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
2	EA	QEL KIT	958003		VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
2	EA	DOOR CONTACT	7766 [COORDINATE WITH DIV. 28]	628	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. DOOR CONTACT TO MONITOR DOOR POSITION. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HS-67**

FOR USE ON DOOR #(S):

95                      99                      207                      211

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA		NO HARDWARE REQUIRED		

**HARDWARE GROUP NO. HS-68**

FOR USE ON DOOR #(S):

90B                      090C                      091B                      092B                      202B                      212F  
 212G                      216                      314D                      314F                      401B                      401C  
 407C                      407D                      417                      418

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
		NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. HS-69**

*FOR USE ON DOOR #(S):*

318

*PROVIDE EACH OPENING WITH THE FOLLOWING:*

<b><u>QTY</u></b>	<b><u>DESCRIPTION</u></b>	<b><u>CATALOG NUMBER</u></b>	<b><u>FINISH</u></b>	<b><u>MFR</u></b>
	NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

TODD COUNTY HORIZONS ACADEMY

**HARDWARE GROUP NO. HO-01**

FOR USE ON DOOR #(S):

BASEBALL  
FIELD

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
4	EA	ENTRANCE/OFFICE LOCK	ALX50J RHO	626	SCH
4	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-02**

FOR USE ON DOOR #(S):

SOFTBALL

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
5	EA	ENTRANCE/OFFICE LOCK	ALX50J RHO	626	SCH
5	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-03**

FOR USE ON DOOR #(S):

110

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

**HARDWARE GROUP NO. HO-04**

FOR USE ON DOOR #(S):

114

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-05**

FOR USE ON DOOR #(S):

103                      106                      107                      108                      109                      113

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	FSIC CORE	23-030 EV29 T	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-06**

FOR USE ON DOOR #(S):

101	102	106C	107C	108C	109C
112	113A				

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	WIRELESS ELECTRONIC LOCK	NDEBJD RHO [BY DIV. 28]	626	SCE
1	EA	PRIMUS CORE	20-740	626	SCH
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE CORRECT STRIKES, FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-07**

FOR USE ON DOOR #(S):

105	115
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PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	DOOR CORD	798C-18	626	SCE
1	EA	NL DRIVE SCREW	090074 (AS REQ'D TO CONVERT LEVER TRIM TO NIGHT LATCH FUNCTION)		VON
1	EA	QEL KIT	958003		VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS [COORDINATE WITH DIV. 28]	LGR	SCE
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		

OPERATIONAL DESCRIPTION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.



**HARDWARE GROUP NO. HO-08**

FOR USE ON DOOR #(S):  
100

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
2	EA	DOOR CORD	798C-18	626	SCE
1	EA	ELEC PANIC HARDWARE	QEL-3349A-EO 24 VDC	626	VON
1	EA	ELEC PANIC HARDWARE	QEL-3349A-NL-OP-388 24 VDC	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	CREDENTIAL READER	MTB15 [BY DIV. 28]	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-2RS [COORDINATE WITH DIV. 28]		VON
	EA	NOTE	BALANCE OF HARDWARE EXISTING TO REMAIN		
	EA	NOTE	REMOVE EXISTING MAG LOCKS		

OPERATIONAL DESCRIPTION: VALID CREDENTIAL MOMENTARILY UNLOCKS DOOR ALLOWING ENTRY. ALWAYS FREE EGRESS.

VERIFY/COORDINATE PREPS ON EXISTING DOORS AND FRAMES. PROVIDE FIELD MODIFICATIONS AND/OR FILLERS TO EXISTING DOORS AND FRAMES AS NECESSARY TO ACCEPT NEW SPECIFIED HARDWARE AND COVER EXPOSED HOLES.

**HARDWARE GROUP NO. HO-09**

FOR USE ON DOOR #(S):

101A	106A	106B	107A	107B	108A
108B	109A	109B	111		

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
		NOTE	NO WORK REQUIRED - EXISTING TO REMAIN		

**HARDWARE GROUP NO. HO-10**

FOR USE ON DOOR #(S):  
104

PROVIDE EACH OPENING WITH THE FOLLOWING:

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
1	EA	NOTE	NO HARDWARE REQUIRED		

END OF SECTION

**SECTION 08 80 00  
GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Glazing units.
- B. Glazing compounds and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- D. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials current edition.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2015).
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2015.
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- I. GANA (SM) - GANA Sealant Manual 2008.
- J. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. ITS (DIR) - Directory of Listed Products current edition.
- L. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
- M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).
- N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.
- O. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data on Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.

- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Insulating Glass Units: One of each glass size and each glass type.

**1.05 QUALITY ASSURANCE**

- A. Perform Work in accordance with for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**1.06 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Glass Fabricators:
  - 1. GGI - General Glass International: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).
  - 2. JE Berkowitz, LP: [www.jeberkowitz.com/#sle](http://www.jeberkowitz.com/#sle).
  - 3. Trulite Glass & Aluminum Solutions, LLC: [www.trulite.com/#sle](http://www.trulite.com/#sle).
  - 4. Substitutions: Refer to Section 01 60 00 - Product Requirements.
- B. Wired Glass Manufacturers:
  - 1. GGI - General Glass International; Wire Glass: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).

**2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Design Pressure: Calculated in accordance with ASCE 7.
  - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
  - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 3. Solar Optical Properties: Comply with NFRC 300 test method.

**2.03 GLASS MATERIALS**

**2.04 GLAZING COMPOUNDS**

- A. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

- B. Type GC-3 - Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920 Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.
- C. Type GC-4 - Polyurethane Sealant: Single component, chemical curing, non-staining, non-bleeding; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; [ ] color.
- D. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; [ ] color.

## 2.05 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
  - 1. Width: As required for application.
  - 2. Thickness: As required for application.
  - 3. Spacer Rod Diameter: As required for application.
  - 4. Manufacturers:
    - a. Pecora Corporation; [ ]: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Tremco Global Sealants; [ ]: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- E. Glazing Clips: Manufacturer's standard type.

## PART 3 EXECUTION

### 3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

### 3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### 3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

**3.04 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)**

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Place setting blocks at 1/4 points and install glazing pane or unit.
- C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.
- D. Fill gaps between glazing and stops with [ ] type sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

**3.05 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- C. Monitor and report installation procedures and unacceptable conditions.

**3.06 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

**3.07 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 09 05 61  
COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Patching compound.
- E. Remedial floor coatings.

**1.02 REFERENCE STANDARDS**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020b.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

**1.05 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
  - 3. Products:

- a. TEC, an H.B. Fuller Construction Products Brand; TEC Feather Edge Skim Coat: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
  1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
  2. Use product recommended by testing agency.

### **PART 3 EXECUTION**

#### **3.01 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    - a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    - b. Removal of existing floor covering.
  2. Preliminary cleaning.
  3. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
  4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  6. Specified remediation, if required.
  7. Patching, smoothing, and leveling, as required.
  8. Other preparation specified.
  9. Adhesive bond and compatibility test.
  10. Protection.
- B. Remediations:
  1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
  3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

#### **3.02 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

#### **3.03 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

**3.04 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

**3.05 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

**3.06 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

**3.07 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION**



**SECTION 09 30 00  
TILING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Coated glass mat backer board as tile substrate.
- E. Ceramic accessories.
- F. Ceramic trim.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 22 40 00 - Plumbing Fixtures: Shower receptor.

**1.03 REFERENCE STANDARDS**

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).
- E. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2010).
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).
- M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2017.

- N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- O. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
- R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.
- T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
- U. ASTM C847 - Standard Specification for Metal Lath 2018.
- V. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- W. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

#### **1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- C. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. All products are Basis of Design for items listed in the plans under finish schedules .
  - 1. Metropolitan; [ww.metroceramics.com/product-section/sizes-and-trims/](http://ww.metroceramics.com/product-section/sizes-and-trims/)
    - a. Color and Size: Mayflower Red - 6x6 (Verify Size and Color Before Order)
    - b. Location: Todd County Middle School - patching at existing restrooms where fixtures are removed.
  - 2. Dal-Tile Corporation: <https://www.daltile.com/product/Color-Wheel-Collection-Classic?color=White&shape=Square>.
  - 3. Color and Size: 4 1/4" x 4 1/4"
  - 4. Location: Todd County Middle School:
    - a. CT-1 :Sunflower DH50 : Plumbing Chase wall in Women's Restroom
    - b. CT-2 : Arctic White 0190 : Short Walls, Floor, and Base
    - c. CT-3: Desert Gray X114 : Long Wall Opposite Plumbing Chase Wall

- d. CT-4: Ocean Blue 1049: Plumbing Chase Wall in Men's Restroom
- 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Glazed Wall Tile, Type Restroom Walls: ANSI A137.1 standard grade.
  - 1. Size: 4 by 4 inch (\_\_\_\_by\_\_\_\_ inch), nominal.
  - 2. Edges: Square.
  - 3. Surface Finish: Matte glaze.
  - 4. Color(s): As indicated on drawings.
  - 5. Trim Units: Matching bead, bullnose, cove, and base shapes in sizes coordinated with field tile.

## 2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Ceramic Trim: Matching bullnose ceramic shapes in sizes coordinated with field tile.
  - 1. Applications:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: Jointed.
    - c. Floor to Wall Joints: Straight base.
  - 2. Manufacturers: Same as for tile.

## 2.03 SETTING MATERIALS

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. Bostik Inc: [www.bostik-us.com/#sle](http://www.bostik-us.com/#sle).
  - 3. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - 4. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 5. Merkrete, by Parex USA, Inc: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  - 6. TEC, an H.B. Fuller Construction Products Brand: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  - 1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

## 2.04 GROUTS

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. Bostik Inc: [www.bostik-us.com/#sle](http://www.bostik-us.com/#sle).
  - 3. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - 4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 5. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  - 6. TEC, an H.B. Fuller Construction Products Brand; [\_\_\_\_]: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
- B. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As selected by Architect from manufacturer's full line.

## 2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  - 1. Applications: Between tile and plumbing fixtures.
  - 2. Products:
    - a. ARDEX Engineered Cements; ARDEX SX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).

- b. Custom Building Products; Commercial 100% Silicone Caulk:  
[www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - c. LATICRETE International, Inc; LATICRETE LATASIL: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - d. Merkrete, by Parex USA, Inc; Merkrete Colored Caulking:  
[www.merkrete.com/#sle](http://www.merkrete.com/#sle).
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
- 1. Composition: Water-based colorless silicone.
  - 2. Products:
    - a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).

## 2.06 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  - 1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
  - 1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
- C. Membrane at Walls:
  - 1. Material: 4 mil (0.1 mm) thick polyethylene film.
- D. Metal Lath: ASTM C847 Flat diamond mesh, of weight to suit application, galvanized finish.
- E. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; not primarily a waterproofing material and having the following characteristics:
- F. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.
- G. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
- H. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

### 3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

**3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

**3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

**3.05 INSTALLATION - WALL TILE**

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- C. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.
- D. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
  - 1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
  - 2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.
- E. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.
- F. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.
- G. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

**3.06 CLEANING**

- A. Clean tile and grout surfaces.

**3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

**SECTION 09 51 00  
ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.
- B. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

**1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.
- E. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- F. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2020.
- J. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.
- K. CHPS (HPPD) - High Performance Products Database Current Edition at [www.chps.net/](http://www.chps.net/).
- L. ISO 14644-1 - Cleanrooms and associated controlled environments - Part 1: Classification of air cleanliness by particle concentration 2015.
- M. UL (FRD) - Fire Resistance Directory Current Edition.
- N. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.

**1.05 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc; Dune - Square Lay-In Edge 15/16, 24 x 24: [armstrongceilings.com/commercial/en-us/commercial-ceilings-walls/dune-square-lay-in-and-tegular-ceiling-tile.html](http://armstrongceilings.com/commercial/en-us/commercial-ceilings-walls/dune-square-lay-in-and-tegular-ceiling-tile.html) .

2. USG Corporation: Radar - Square Edge 15/16, 24 x 24 and 24 x 48 - White :  
[usg.com/content/usgcom/en/products/ceilings/ceiling-tiles-panels/acoustical-panels/radar-acoustical-panels.2210.html](http://usg.com/content/usgcom/en/products/ceilings/ceiling-tiles-panels/acoustical-panels/radar-acoustical-panels.2210.html)
3. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Suspension Systems:
1. Same as for acoustical units.

## 2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
1. Local authorities having jurisdiction.

## 2.03 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
1. VOC Content: Certified as Low Emission by one of the following:
    - a. Product listing in UL (GGG).
    - b. Product listing in CHPS (HPPD).
- B. Acoustical Panels, Type Standard: Painted mineral fiber, with the following characteristics:
1. Classification: ASTM E1264 Type III.
    - a. Form: 1, nodular.
    - b. Pattern: "A" - perforated, regularly spaced large holes.
  2. Size: 24 by 24 inches (610 by 610 mm) and 24 by 48.
  3. Thickness: 3/4 inch (19 mm).
  4. Panel Edge: Square.
  5. Color: White.
  6. Suspension System: Exposed grid.
  7. Products:
    - a. USG Corporation; Radar Acoustical Panels: [www.usg.com/#sle](http://www.usg.com/#sle).
    - b. Armstrong Ceiling Solutions ; Dune : [armstrongceilings.com](http://armstrongceilings.com).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
1. Materials:
    - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  2. Profile: Tee; 15/16 inch (24 mm) face width.
  3. Products:
    - a. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: [www.usg.com/#sle](http://www.usg.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

**3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

**3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch (19 mm) clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

**3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

**3.05 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**



**SECTION 09 65 00  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

**1.03 REFERENCE STANDARDS**

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- C. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.

**1.04 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 4 by 4 inch (\_\_\_\_ by \_\_\_\_ mm) in size illustrating color and pattern for each resilient flooring product specified.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
- D. Do not double stack pallets.

**1.06 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

**PART 2 PRODUCTS**

**2.01 TILE FLOORING**

- A. Vinyl Composition Tile - Type [\_\_\_\_]: Homogeneous, with color extending throughout thickness.
  - 1. Manufacturers:
    - a. Armstrong Flooring; <https://www.armstrongflooring.com/commercial/en-us/products/vinyl-composition-tile/std-excelon-imp-texture/item/51910.html>
      - 1) Color and Size: Classic Black Standard Excelon 12x12 VCT
      - 2) Location: Todd County High School - Patching existing cafeteria flooring.
    - b. Johnsonite, a Tarkett Company; [\_\_\_\_]: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
  - 3. Size: 12 by 12 inch (305 by 305 mm).
  - 4. Thickness: 0.125 inch (3.2 mm).
  - 5. Color: Classic Black Standard Excelon.

**2.02 RESILIENT BASE**

- A. Resilient Base - Type [\_\_\_\_]: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
  - 1. Manufacturers:
    - a. Johnsonite, a Tarkett Company; [\_\_\_\_]: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - b. Roppe Corp; [\_\_\_\_]: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Height: 4 inch (100 mm).
  - 3. Finish: Satin.
  - 4. Color: To be selected by Architect from manufacturer's full range.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

**3.02 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  - 1. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 05 26 for grounding and bonding to building grounding system.
  - 2. Fit joints and butt seams tightly.
  - 3. Set flooring in place, press with heavy roller to attain full adhesion.

**3.03 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

**3.04 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

**3.05 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

**3.06 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION**

**SECTION 09 84 36.12**  
**SOUND-ABSORBING BAFFLE PANELS**

**PART 1 GENERAL**

1.01 SECTION INCLUDES

- A. Sound-absorbing baffle panels, custom-fabricated with sewn edge (SE).

1.02 REFERENCES

- A. ASTM International
  - 1. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 3. ASTM E795 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
  - 1. Surface Burning Characteristics (ASTM E84):
    - a. Flamespread: 25, maximum.
    - b. Smoke Developed: 450, maximum.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data sheet, for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, edge profiles and baffle components, including suspension method, accessories, finish colors and textures.
- D. Samples: Submit selection and verification samples of finishes, colors and textures.
- E. Test Reports: Certified test reports showing compliance with specified performance requirements.
  - 1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with Division 1 Product Requirements Section.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions. Environmental conditions required for

storage are the same as for installation, see 1.06 A. Project Conditions.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install baffles until wet work, such as concrete and plastering, is complete; the building is enclosed; and the temperature and relative humidity are stabilized at 60 - 80 degrees F (16 - 27 degrees C) and 40% to 50%, respectively.

**PART 2 PRODUCTS**

2.01 SOUND-ABSORBING BAFFLE PANELS

- A. Manufacturer: Kinetics Noise Control, Inc.  
1. Contact: PO Box 655, 6300 Irelan Place, Dublin, OH 43017; Telephone: (614) 889-0480; Fax: (614) 889-0540; E-mail: [intsales@kineticsnoise.com](mailto:intsales@kineticsnoise.com); Web site: [www.kineticsnoise.com](http://www.kineticsnoise.com).
- B. Substitutions: No substitutions permitted.

## 2.02 MANUFACTURED UNITS

### A. Wave Baffle Type SE

1. Baffles shall be a nominal 2 inch thick.

*NOTE TO SPECIFIER – Other insulation thicknesses are available. The standard 2 inch thick insulation is based on economy and performance, which is primarily the result of the positioning of the sound absorptive baffles and, to a lesser degree, the insulation thickness.*

2. Size: As shown on drawings up to a maximum 4 feet wide and 30 feet long.
3. Core shall be 2 inch thick fiberglass, 1 pcf density.
4. Facing:[1.5 ounce sewn ripstop sailcloth] [Webcore Vinyl][Factory approved fabric]. All edges face wrapped and stitched. Suspension eyelets across each 4 feet side as required.
  - a. Color: As selected from the manufacturer's standard range of fire rated materials.
5. Sound Absorption (ASTM C423, JMounting), Sabins per square foot of baffle to meet the following minimum in each frequency band:

<u>125Hz</u>	<u>250Hz</u>	<u>500Hz</u>	<u>1000Hz</u>	<u>2000Hz</u>
.46	.80	1.26	1.47	1.27

Testing of baffles must be in a typical horizontally suspended catenary position replicating a ceiling/roof installation. Type E400 mounting is not acceptable.

6. Mounting: Wire, cable, or other approved hanging mechanism attached to brass-plated grommets.

*NOTE TO SPECIFIER –For corrosive environments, specify stainless steel grommets.*

7. Vertically hung baffles, as shown on the drawings, will be suspended through grommets designed to carry the baffle weight without tearing or pulling out.

## PART 3 EXECUTION

*NOTE TO SPECIFIER – Paragraph below is an addition to CSI SectionFormat and a supplement to specifications. Retain or delete paragraph below per project requirements and specifier's practice.*

### 3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

### 3.02 EXAMINATION

- A. Site Verification of Conditions: Verify that the supporting structure for suspension of acoustical baffles previously installed under other sections, is acceptable for product installation in accordance with manufacturer's instructions.
  1. Do not install baffles until unsatisfactory conditions are corrected.

### 3.03 CLEANING

- A. Follow manufacturer's instructions for cleaning baffles soiled during installation. Replace baffles that cannot be cleaned to as new condition.

- B. Keep site free from accumulation of waste and debris.

**END OF SECTION**

**SECTION 09 91 13  
EXTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Floors, unless specifically indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- C. Section 05 51 00 - Metal Stairs: Shop-primed items.
- D. Section 09 91 23 - Interior Painting.
- E. Section 09 93 00 - Staining and Transparent Finishing. Wood substrates.
- F. Section 09 96 00 - High-Performance Coatings.
- G. Section 09 97 25 - Mineral-Based Coatings.
- H. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Painted identification.
- I. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Color coding scheme for items to be painted under this section.
- J. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Painted identification.
- K. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Color coding scheme for items to be painted under this section.
- L. Section 23 05 53 - Identification for HVAC Piping and Equipment: Painted identification.
- M. Section 23 05 53 - Identification for HVAC Piping and Equipment: Color coding scheme for items to be painted under this section.
- N. Section 26 05 53 - Identification for Electrical Systems: Painted identification.
- O. Section 26 05 53 - Identification for Electrical Systems: Color coding scheme for items to be painted under this section.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- F. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
- G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1 2016.
- H. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- I. SSPC-SP 2 - Hand Tool Cleaning 2018.
- J. SSPC-SP 3 - Power Tool Cleaning 2018.
- K. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- L. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

#### **1.05 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Samples: Submit two paper chip samples, 12"x12" inch (304x304 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
- C. Manufacturer's Instructions: Indicate special surface preparation procedures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

#### **1.06 QUALITY ASSURANCE**

##### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

##### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  - 1. Base Manufacturer: Sherwin-Williams.
  - 2. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.



D. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated in Color Schedule.
  - 1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
  - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## 2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood, and primed metal.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
    - a. Products:
      - 1) Behr Premium Interior/Exterior Direct-To-Metal Paint Gloss [No. 8200]. (MPI #119)
      - 2) Behr Premium Plus Exterior Semi-Gloss Enamel [No. 5050].
      - 3) Behr Premium Plus Interior/Exterior Hi-Gloss Enamel [No. 8050]. (MPI #119)
      - 4) Behr Pro e600 Exterior Semi-Gloss Paint [No.PR670]. (MPI #11)
      - 5) Kilz Pro-X 610 Exterior Flat [No. PX610].
      - 6) Kilz Pro-X Exterior Flat [No. PX613].
      - 7) Sherwin-Williams Loxon Self-Cleaning Acrylic Exterior, Satin.
      - 8) Sherwin-Williams Loxon XP Exterior. (MPI #10)
      - 9) Sherwin-Williams Solo Series, Semi-Gloss. (MPI #11)
      - 10) Sherwin-Williams Resilience, Satin. (MPI #15)
      - 11) Sherwin-Williams SuperPaint Exterior.
      - 12) Substitutions: Section 01 60 00 - Product Requirements.

## 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer; MPI #3.
    - a. Products:
      - 1) Behr Concrete and Masonry Bonding Primer [No. 880].
      - 2) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #3)

- 3) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
- 4) Sherwin-Williams Loxon Water Blocking Primer/Finish.
- 5) Substitutions: Section 01 60 00 - Product Requirements.
2. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
  - a. Products:
    - 1) PPG Devguard Multi-Purpose Primer, 4160 Series. (MPI #76)
    - 2) Sumter Coatings, Inc. Universal Inhibitive Primer.
    - 3) Sumter Coatings, Inc. Heavy Duty Inhibitive Primer, 99-Series.
3. Alkyd Primer for Galvanized Metal.
  - a. Products:
    - 1) PPG Paints Speedhide Interior/Exterior Galvanized Steel Primer, 6-209 Series.

## 2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  1. Exterior Plaster and Stucco: 12 percent.
  2. Fiber Cement Siding: 12 percent.
  3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
  5. Concrete Floors and Traffic Surfaces: 8 percent.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
  1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
  3. Clean concrete according to ASTM D4258. Allow to dry.
  4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  2. Prepare surface as recommended by top coat manufacturer.
  3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
- H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- I. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  2. Prepare surface according to SSPC-SP 2.
- J. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
  2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### **3.06 COLOR SCHEDULE**

**END OF SECTION**

**SECTION 09 91 23  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other tiles.
  - 9. Glass.
  - 10. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 91 13 - Exterior Painting.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- F. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).
- G. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1 2016.
- H. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- I. SSPC-SP 2 - Hand Tool Cleaning 2018.
- J. SSPC-SP 3 - Power Tool Cleaning 2018.
- K. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- L. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Samples: Submit two paper chip samples, 12x12 inch (304x304 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.

**1.06 MOCK-UP**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 10 feet (6 m) long by FULL HEIGHT, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Mock-up may remain as part of the work.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

**1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

**2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
  - 1. Selection to be made by Architect after award of contract.
  - 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
  - 3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  - 4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
  - 5. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

### 2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
    - a. Products:
      - 1) Behr Premium Plus Interior Eggshell Enamel [No. 2050]. (MPI #145)
      - 2) Behr Pro i300 Interior Eggshell Paint [No.PR330]. (MPI #145)
      - 3) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #144)
      - 4) Sherwin-Williams ProMar 200 HP Series, Low Gloss Eg-Shel. (MPI #144)
      - 5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #144)
      - 6) Substitutions: Section 01 60 00 - Product Requirements.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  - 2. Two top coats and one coat primer.
  - 3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
    - a. Products:
      - 1) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)
      - 2) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
      - 3) Sherwin-Williams Waterbased Catalyzed Epoxy, Gloss.

### 2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer; MPI #3.
    - a. Products:
      - 1) Behr Concrete and Masonry Bonding Primer [No. 880].
      - 2) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #3)
      - 3) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
      - 4) Sherwin-Williams Loxon Water Blocking Primer/Finish.
  - 2. Interior/Exterior Latex Block Filler; MPI #4.
    - a. Products:
      - 1) Kilz Pro-X p50 Block Filler Primer.
      - 2) Sherwin-Williams ConFlex Block Filler. (MPI #4)
      - 3) Sherwin-Williams Loxon Block Surfacer. (MPI #4)

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Plaster and Stucco: 12 percent.
  - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
  - 3. Clean concrete according to ASTM D4258. Allow to dry.
  - 4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
  - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  - 2. Prepare surface as recommended by top coat manufacturer.
  - 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
- I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Galvanized Surfaces:
- M. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- N. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

### 3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**



**SECTION 10 21 13.13  
METAL TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal toilet compartments.
- B. Urinal and Vestibule screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.

**1.03 REFERENCE STANDARDS**

- A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Toilet Compartments:
  - 1. All American Metal Corp - AAMCO; [\_\_\_\_]: [www.allamericanmetal.com/#sle](http://www.allamericanmetal.com/#sle).
  - 2. Global Steel Products Corp; [\_\_\_\_]: [www.globalpartitions.com/#sle](http://www.globalpartitions.com/#sle).
  - 3. Metpar Corp; [\_\_\_\_]: [www.metpar.com/#sle](http://www.metpar.com/#sle).
  - 4. Substitutions: Section 01 60 00 - Product Requirements.

**2.02 MATERIALS**

- A. Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel.
- B. Stainless Steel Sheet: ASTM A666, Type 304.

**2.03 COMPONENTS**

- A. Toilet Compartments: Stainless steel, floor-mounted headrail-braced.
- B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
- C. Door and Panel Dimensions:
  - 1. Thickness: 1 inch (25 mm).
  - 2. Door Width: 24 inch (610 mm).
  - 3. Door Width for Handicapped Use: 36 inch (915 mm) , out-swinging.
- D. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.
- E. Urinal Screen Splash Panels: Stainless steel sheet 30 inch (76 mm) wide by 42 inch (1,066 mm) high mounted on partitions adjacent to urinals. Fasten with stainless steel screws spaced 8 inches (20 mm) on center.

**2.04 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (175 mm) high, concealing floor fastenings.
  - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow stainless steel tube, 1 by 1-5/8 inch (25 by 41 mm) size, with anti-grip strips and cast socket wall brackets.
- C. Brackets: Satin stainless steel.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
  - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hardware: Satin chrome plated non-ferrous cast metal:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  - 2. Thumb turn or sliding door latch with exterior emergency access feature.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

**2.05 FINISHING**

- A. Stainless Steel Compartments: No. 4 finish.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that field measurements are as indicated.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

**3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

**3.03 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

**END OF SECTION**

**SECTION 10 28 00  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Under-lavatory pipe supply covers.
- D. Electric hand/hair dryers.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 30 00 - Tiling: Ceramic washroom accessories.

**1.03 ABBREVIATIONS AND ACRONYMS**

- A. PPE: Personal Protective Equipment.

**1.04 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- G. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2018.
- H. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.
- I. ASTM C1036 - Standard Specification for Flat Glass 2016.
- J. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- K. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- L. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2015.
- M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- N. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).
- O. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- P. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

**1.06 SUBMITTALS**

- A. See Section 01 30 00 - Electronic/Digital Submittals, for submittal procedures.

- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Commercial Toilet, Shower, and Bath Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Georgia-Pacific Professional: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
  - 5. Bobrick; <https://www.bobrick.com/>.
  - 6. Substitutions: Section 01 60 00 - Product Requirements.
- B. Under-Lavatory Pipe Supply Covers:
  - 1. Plumberex Specialty Products, Inc: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).
- C. Electric Hand/Hair Dryers:
  - 1. American Dryer, Inc: [www.americandryer.com/#sle](http://www.americandryer.com/#sle).
  - 2. Excel Dryer: [www.exceldryer.com/#sle](http://www.exceldryer.com/#sle).
  - 3. Frost Products Limited: [www.frostproductsltd.com/#sle](http://www.frostproductsltd.com/#sle).
  - 4. Mitsubishi Electric Trane HVAC US LLC: [www.mitsubishielectric.com/#sle](http://www.mitsubishielectric.com/#sle).
  - 5. World Dryer Corporation: [www.worlddryer.com/#sle](http://www.worlddryer.com/#sle).

### **2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Zinc Alloy: Die cast, ASTM B86.
- F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- G. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- H. Adhesive: Two component epoxy type, waterproof.
- I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### **2.03 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Powder Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats powder coat enamel.
- E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- F. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- G. Back paint components where contact is made with building finishes to prevent electrolysis.

**2.04 COMMERCIAL TOILET ACCESSORIES**

- A. Toilet Paper Dispenser: Single roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
- B. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
  - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
  - 2. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  - 3. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
  - 4. Fixed Tilt Mirrors: Minimum 3 inches (75 mm) tilt from top to bottom.
- C. Grab Bars: Stainless steel, smooth surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
    - b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
    - c. Finish: Satin.
    - d. Length and Configuration: As indicated on drawings.

**2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS**

- A. Under-Lavatory Pipe and Supply Covers:
  - 1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
  - 2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
  - 3. Construction: 1/8 inch (3.2 mm) flexible PVC.
    - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    - b. Comply with ASTM C1822, type indicated.
    - c. Comply with ASME A112.18.9.
    - d. Comply with ICC A117.1.
    - e. Microbial and Fungal Resistance: Comply with ASTM G21.
  - 4. Color: White.
  - 5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
  - 6. Products:
    - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).
    - b. Plumberex Specialty Products, Inc; Plumberex Trap Gear: [www.plumberex.com/#sle](http://www.plumberex.com/#sle).

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

**3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

**3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  - 1. Grab Bars: As indicated on drawings.
  - 2. Electric Hand Dryers: Measured from floor to bottom of nozzle:
    - a. Men: 44 inches (1110 mm).
    - b. Women: 42 inches (1060 mm).
    - c. Teenager: 41 inches (1035 mm).
    - d. Child: 32 inches (810 mm).
    - e. Handicap: 36 inches (910 mm).

**3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

## SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Pipes, fittings, and specialties.
  2. Sprinklers.
  3. Control panels.

#### 1.2 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Project Scope:
1. Areas where ceiling removed and replaced, remove existing sprinkler heads and rework for new ceiling layout. See drawings for more information.
- C. Shop Drawings: For wet-pipe sprinkler systems.
1. Submit sprinkler heads / Piping for area revisions.
- D. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Design Data:
1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties 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. 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.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with NFPA 13 .
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.
- E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.
  - 1. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.



- F. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7 .

## 2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, Black- Steel Pipe: ASTM A53/A53M, Type E , Grade B . Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Black- Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, Type E ; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- E. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M thinwall with plain ends and wall thickness less than Schedule 10.
- F. Hybrid Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
- G. Schedule 5 Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall with plain ends.
- H. Galvanized- and Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- I. Galvanized- and Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- J. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- K. Malleable- or Ductile-Iron Unions: UL 860.
- L. Cast-Iron Flanges: ASME 16.1, Class 125.
- M. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- N. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- O. Grooved-Joint, Steel-Pipe Appurtenances:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International.
    - b. CPS Products, Inc.
    - c. Victaulic Company.
  2. Pressure Rating: 250-psig minimum.
  3. Galvanized Uncoated Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
  4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- P. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Victaulic Company.

## 2.3 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Tyco by Johnson Controls Company.
  2. Victaulic Company.
  3. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum .
- F. Automatic Sprinklers with Heat-Responsive Element:
1. Early-Suppression, Fast-Response Applications: UL 1767 .
  2. Nonresidential Applications: .
  3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

- G. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
  - 1. Nominal Orifice:
    - a. 1/2 inch, with discharge coefficient K between 5.3 and 5.8 .
    - b. 17/32 inch with discharge coefficient K between 7.4 and 8.2 .
- 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 Chrome-plated steel, two piece, with 1-inch vertical adjustment .
  - 2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.
- J. Sprinkler Guards:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Tyco by Johnson Controls Company.
    - b. Victaulic Company.
    - c. Viking Corporation.
  - 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.4 CONTROL PANELS

- A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.
  - 1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
  - 2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
  - 3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Panels Components:
  - 1. Power supply.
  - 2. Electrically supervised solenoid valves and polarized fire-alarm bell.
  - 3. Lamp test facility.
  - 4. Single-pole, double-throw auxiliary alarm contacts.
  - 5. Rectifier.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

#### 3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

#### 3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
- N. Fill sprinkler system piping with water.
- O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

#### 3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall and Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
- P. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

### 3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
- E. Air Vent:
  - 1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
  - 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
  - 3. Pipe from outlet of air vent to drain.

### 3.6 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.

### 3.7 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."

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Coordinate with fire-pump tests. Operate as required.
  - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.9 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.

### 3.10 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
  - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  - 2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.



3. Standard-weight , galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger , shall be one of the following:
1. Standard-weight , black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight , galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  3. Standard-weight , black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  4. Standard-weight , galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers .
  2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
  3. Wall Mounting: Sidewall sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
  3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  4. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

## SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Sleeves.
  2. Sleeve-seal systems.
  3. Grout.

#### 1.2 ACTION SUBMITTALS

#### 1.3 INFORMATIONAL SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CALPICO, Inc.
  2. GPT; an EnPro Industries company.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

#### 2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
  2. CALPICO, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber High-temperature-silicone Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel Composite plastic Stainless steel Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6 : Steel pipe sleeves .

END OF SECTION 220517

## SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

#### 1.2 ACTION SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Mid-America Fittings, Inc.
3. ProFlo; a Ferguson Enterprises, Inc. brand.

#### 2.2 ESCUTCHEONS

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  1. Escutcheons for New Piping and Relocated Existing Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.

- b. Chrome-Plated Piping: One-piece steel or split-casting brass with polished, chrome-plated finish.
- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
- e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.

END OF SECTION 220518

## SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

### PART 3 - EXECUTION

#### 3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

#### 3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

#### 3.3 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
  - 1. Brass ball valves, two-piece with full port and brass trim.

#### 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Brass ball valves, two-piece with full port and brass trim. Provide with threaded solder [or] -joint ends.

END OF SECTION 220523.12



## SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Bronze swing check valves.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 4. ASME B16.18 for solder joint.
  - 5. ASME B31.9 for building services piping valves.
- C. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valve Bypass and Drain Connections: MSS SP-45.

#### 2.2 BRONZE SWING CHECK VALVES

- A. Bronze Swing Check Valves with Bronze Disc, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Flow Controls; Conbraco Industries, Inc.

- b. Hammond Valve.
- c. NIBCO INC.
- 2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded or soldered. See valve schedule articles.
  - f. Disc: Bronze.

## PART 3 - EXECUTION

### 3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

### 3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

### 3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze swing check valves bronze disc, Class 125, with soldered or threaded end connections.

END OF SECTION 220523.14

## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fastener systems.
4. Pipe-positioning systems.
5. Equipment supports.

#### 1.2 ACTION SUBMITTALS

#### 1.3 INFORMATIONAL SUBMITTALS

#### 1.4 QUALITY ASSURANCE

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7 .
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

## 2.2 METAL PIPE HANGERS AND SUPPORTS

### A. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of steel .

## 2.3 TRAPEZE PIPE HANGERS

- ### A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## 2.4 FASTENER SYSTEMS

- ### A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, 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: Subject to compliance with requirements, provide products by one of the following:
  - a. Eaton (B-line).
  - b. Empire Tool and Manufacturing Co., Inc.
  - c. Hilti, Inc.
2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

## 2.5 PIPE-POSITIONING SYSTEMS

- ### A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.6 EQUIPMENT SUPPORTS

- ### A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

## 2.7 MATERIALS

- ### A. Aluminum: ASTM B 221.
- ### B. Carbon Steel: ASTM A 1011/A 1011M.
- ### C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

#### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- G. 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.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal Hanger Shields: Install with insulation of 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 bearing surface smooth.

- 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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

### 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 .

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 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 finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:



1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  5. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  6. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- L. 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. C-Clamps (MSS Type 23): For structural shapes.
- M. 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.
- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

- O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Warning tags.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, undefined:
  - a. Brady Corporation.
  - b. emedco.
  - c. Seton Identification Products; a Brady Corporation company.
2. Letter Color: White .
3. Background Color: Black .
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

- B. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. emedco.
  - 3. Seton Identification Products; a Brady Corporation company.

## 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 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. Near major equipment items and other points of origination and termination.
  - 5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
  - 1. Low-Pressure Compressed Air Piping:
    - a. Background: Safety blue .
    - b. Letter Colors: White .
  - 2. Domestic Water Piping
    - a. Background: Safety green .
    - b. Letter Colors: White .

3.3 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

## SECTION 220719 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Roof drains and rainwater leaders.
  - 5. Supplies and drains for handicap-accessible lavatories and sinks.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

#### 1.4 QUALITY ASSURANCE

- A. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Johns Manville; a Berkshire Hathaway company.
  - b. Owens Corning.
2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ .
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- 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 attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.



- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, 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 that of 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 that 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 that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 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 2 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, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
  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.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

#### A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as that of 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 that of 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.

### 3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. 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 cut sections of block insulation of same material and thickness as that of pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.11 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  - 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

### 3.12 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

3.13 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.

3.14 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 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 thick.
- C. Roof Drain and Overflow Drain Bodies:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719



## SECTION 221116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Copper tube and fittings.
2. Galvanized-steel pipe and fittings.
3. PEX tube and fittings.
4. PVC pipe and fittings.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.

#### 1.3 INFORMATIONAL SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- ##### A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

#### 2.2 COPPER TUBE AND FITTINGS

- ##### A. Drawn-Temper Copper Tube: ASTM B88, Type K .
- ##### B. Annealed-Temper Copper Tube: ASTM B88, Type K .
- ##### C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- ##### D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- ##### E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- ##### F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

- G. Wrought Copper Unions: ASME B16.22.
  - H. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.
    - 1. Description: Tee formed in copper tube in accordance with ASTM F2014.
  - I. Grooved, Mechanical-Joint, Copper Tube Appurtenances:
    - 1. Manufacturers: Subject to compliance with requirements, undefined:
      - a. Anvil International.
      - b. Grinnell G-Fire by Johnson Controls Company.
    - 2. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
    - 3. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F , for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.
  - J. Copper Tube, Pressure-Seal-Joint Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - a. Apollo Flow Controls; Conbraco Industries, Inc.
      - b. Elkhart Products Corporation.
      - c. Viega LLC.
    - 2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
    - 3. Minimum 200-psig working-pressure rating at 250 deg F.
  - K. Copper-Tube, Push-on-Joint Fittings:
    - 1. Manufacturers: Subject to compliance with requirements, undefined:
      - a. Apollo Flow Controls; Conbraco Industries, Inc.
      - b. Elkhart Products Corporation.
    - 2. Description:
      - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      - b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.
- 2.3 GALVANIZED-STEEL PIPE AND FITTINGS
- A. Galvanized-Steel Pipe:
    - 1. ASTM A53/A53M, Type E , Grade B , Standard Weight.
    - 2. Include ends matching joining method.
  - B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.
  - C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

- D. Malleable-Iron Unions:
  - 1. ASME B16.39, Class 150.
  - 2. Hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal, bronze seating surface.
  - 4. Threaded ends.
- E. Flanges: ASME B16.1, Class 125, cast iron.
- F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International.
    - b. Grinnell G-Fire by Johnson Controls Company.
    - c. Shurjoint-Apollo Piping Products USA Inc.
  - 2. ASTM Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
  - 3. AWWA Fittings for Grooved-End, Galvanized-Steel Pipe:
    - a. AWWA C606 for steel-pipe dimensions.
    - b. Ferrous housing sections.
    - c. EPDM-rubber gaskets suitable for hot and cold water.
    - d. Bolts and nuts.
    - e. Minimum Pressure Rating:
      - 1) NPS 8 and Smaller: 600 psig .
      - 2) NPS 10 and NPS 12: 400 psig .
      - 3) NPS 14 to NPS 24: 250 psig .

## 2.4 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D1785, with wall thickness as indicated in "Piping Applications" Article.
  - 1. Manufacturers: Subject to compliance with requirements, undefined:
    - a. IPEX USA LLC.
- B. PVC Socket Fittings: ASTM D2466 for Schedule 40 and ASTM D2467 for Schedule 80.
- C. PVC Schedule 80 Threaded Fittings: ASTM D2464.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Aboveground domestic water piping, NPS 2 and smaller , shall be one of the following:
  - 1. Drawn-temper copper tube, ASTM B88, Type L ; cast- [or] wrought-copper, solder-joint fittings; and brazed soldered joints.
  - 2. Drawn-temper copper tube, or ; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. Drawn-temper copper tube, or ; copper push-on-joint fittings; and push-on joints.
  - 4. CPVC, ; socket fittings; and solvent-cemented joints.
  - 5. PVC, ; socket fittings; and solvent-cemented joints.
  - 6. Polypropylene (PP-R), pipe and socket fusion, butt fusion, fusion outlet, or electrofusion fittings and joints.

### 3.2 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- D. Install domestic water piping level with 0.25 percent slope downward toward drain without pitch and plumb.
- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

- N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
- G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
- H. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- I. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D2855.

- J. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
- K. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
- L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 INSTALLATION OF TRANSITION FITTINGS

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- C. Install hangers for copper ductile iron galvanized steel and stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install vinyl-coated hangers for CPVC PVC and PP piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- F. Support horizontal piping within 12 inches of each fitting.
- G. Support vertical runs of copper ductile iron galvanized steel and stainless steel tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- H. Support vertical runs of CPVC PVC and PP-R piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- I. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.8 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.9 CLEANING

- A. Clean and disinfect 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 of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
- B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116



## SECTION 221316 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

#### 1.2 SUMMARY

##### A. Section Includes:

1. PVC pipe and fittings.

#### 1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- ##### A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water .

- ##### B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

#### 2.2 PVC PIPE AND FITTINGS

- ##### A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- ##### B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- ##### C. Adhesive Primer: ASTM F 656.
- ##### D. Solvent Cement: ASTM D 2564.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. 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. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. 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.
  - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  3. Maintain swab in piping and pull past each joint as completed.
- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
  3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- P. Install underground, ductile-iron, force-main piping according to AWWA C600.
1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
  2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- Q. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- R. Install force mains at elevations indicated.
- S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.2 JOINT CONSTRUCTION

- A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
1. Cut threads full and clean using sharp dies.
  2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    - c. Do not use pipe sections that have cracked or open welds.

- B. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

### 3.3 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 waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Install horizontal backwater valves with cleanout cover flush with floor .
- D. Connect force-main piping to the following:
  - 1. Sanitary Sewer: To exterior force main.
  - 2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.4 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.5 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 waste 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.
    - a. 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 waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. 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.
    - a. 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.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. 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.

- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.
    - a. Isolate test source and allow to stand for four hours.
    - b. Leaks and loss in test pressure constitute defects that must be repaired.
  - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 4. Prepare reports for tests and required corrective action.

### 3.6 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.7 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  2. Dissimilar Pipe-Material Couplings: , nonpressure transition couplings.

END OF SECTION 221316

## SECTION 224213.13 - COMMERCIAL WATER CLOSETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wall-mounted water closets.
  - 2. Flushometer valves.
  - 3. Toilet seats.
  - 4. Supports.

#### 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 water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

### PART 2 - PRODUCTS

#### 2.1 WALL-MOUNTED WATER CLOSETS

- A. Water Closets, Wall Mounted, Top Spud , Accessible :
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard.
    - b. Sloan Valve Company.
    - c. Zurn Industries, LLC.
  - 2. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Siphon jet.
    - d. Style: Flushometer valve.
    - e. Height: Standard.
    - f. Rim Contour: Elongated.



- g. Water Consumption: 1.28 gal. per flush.
- h. Spud Size and Location: NPS 1-1/2; top.
- 3. Support: Water closet carrier .
- 4. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

## 2.2 FLUSHOMETER VALVES

### A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves :

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Sloan Valve Company.
  - c. Zurn Industries, LLC.
- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig.
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Concealed.
- 9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 11. Consumption: 1.28 gal. per flush.
- 12. Minimum Inlet: NPS 1.
- 13. Minimum Outlet: NPS 1-1/4.

## 2.3 TOILET SEATS

### A. Toilet Seats :

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Jones Stephens Corp.
  - c. Zurn Industries, LLC.
- 2. Standard: IAPMO/ANSI Z124.5.
- 3. Material: Plastic.
- 4. Type: Commercial (Standard) .
- 5. Shape: Elongated rim, open front .
- 6. Hinge: Check Self-sustaining Self-sustaining, check Self-raising.
- 7. Hinge Material: Noncorroding metal.
- 8. Color: White .

## 2.4 SUPPORTS

### A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

## 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 water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

#### A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

#### B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

#### C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### 3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### 3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

## SECTION 224213.16 - COMMERCIAL URINALS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wall-hung urinals.
2. Urinal flushometer valves.

#### 1.2 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 urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

### PART 2 - PRODUCTS

#### 2.1 WALL-HUNG URINALS

A. Urinals - Wall Hung, Back Outlet, Washdown: Accessible .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Sloan Valve Company.
2. Fixture:
  - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
  - b. Material: Vitreous china.
  - c. Type: Washdown with extended shields.
  - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
  - e. Water Consumption: 0.5 gpf .
  - f. Spud Size and Location: NPS 3/4, .
  - g. Outlet Size and Location: NPS 2, back.
  - h. Color: White .
3. Waste Fitting:
  - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
  - b. Size: NPS 2.
4. Support: with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
5. Urinal Mounting Height: Standard Handicapped/elderly according to ICC A117.1.

## 2.2 URINAL FLUSHOMETER VALVES

### A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sloan Valve Company.
  - b. Zurn Industries, LLC.
2. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Concealed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 1.0 gal. per flush.
12. Minimum Inlet: NPS 3/4 NPS 1 .
13. Minimum Outlet: NPS 3/4 NPS 1-1/4 .

## 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 urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. Urinal Installation:

1. Install urinals level and plumb according to rough-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC A117.1.
5. Install trap-seal liquid in waterless urinals.

#### B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

### 3.3 PIPING CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

### 3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16



## SECTION 224216.13 - COMMERCIAL LAVATORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

#### 1.2 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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

### PART 2 - PRODUCTS

#### 2.1 ENAMELED, CAST-IRON, COUNTER-MOUNTED LAVATORIES

A. Lavatory : Rectangular, flat rim, enameled, cast iron, flush counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Commercial Enameling Company.
  - b. Kohler Co.
2. Fixture:
  - a. Standard: ASME A112.19.1/CSA B45.2.
  - b. Type: For flush mounting with kit.
  - c. Nominal Size: Rectangular, 18 by 15 inches 20 by 18 inches .
  - d. Faucet-Hole Punching: Three holes, 2-inch Three holes, 4-inch centers.
  - e. Faucet-Hole Location: Top.
  - f. Color: White .
  - g. Mounting Materials: With stainless-steel ring, and sealant.

B. Lavatory : Oval, self-rimming, enameled, cast iron, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kohler Co.
  - b. Zurn Industries, LLC.
2. Fixture:
  - a. Standard: ASME A112.19.1/CSA B45.2.
  - b. Type: Self-rimming for above-counter mounting.
  - c. Nominal Size: Oval, 20 by 17 inches 24 by 18 inches .
  - d. Faucet-Hole Punching: One hole Three holes, 2-inch centers Three holes, 4-inch centers.
  - e. Faucet-Hole Location: Top.
  - f. Color: White .
  - g. Mounting Material: Sealant.

C. Lavatory : Oval, enameled, cast iron, undercounter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Kohler Co.
2. Fixture:
  - a. Standard: ASME A112.19.1/CSA B45.2.
  - b. Type: For undercounter mounting.
  - c. Nominal Size: Oval, 24 by 18 inches .
  - d. Faucet-Hole Punching: No holes.
  - e. Faucet-Hole Location: On countertop.
  - f. Color: White .
  - g. Mounting Materials: Sealant and undercounter mounting kit.

## 2.2 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  1. Size: NPS 1-1/2 by NPS 1-1/4 NPS 1-1/4 .
  2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall ; and chrome-plated, brass or steel wall flange.
  3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

## 2.3 SUPPORTS

- A. Type II Lavatory Carrier:
  1. Standard: ASME A112.6.1M.
- B. Type III Lavatory Carrier:

1. Standard: ASME A112.6.1M.

### 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 lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

#### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

## SECTION 224216.16 - COMMERCIAL SINKS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Handwash sinks.
2. Manually operated sink faucets.
3. Automatically operated sink faucets.
4. Supply fittings.
5. Waste fittings.
6. Sink supports.

#### 1.2 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 sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

#### 1.3 INFORMATIONAL SUBMITTALS

#### 1.4 CLOSEOUT SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 HANDWASH SINKS

##### A. Handwash Sinks - Stainless Steel: .

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Elkay.
  - b. Sloan Valve Company.
2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:
  - a. Standards:
    - 1) ASME A112.19.3/CSA B45.4.
    - 2) NSF 61.

- b. Type: Wall-mounted Pedestal-base stainless steel basin with radius corners, back for faucet, and support brackets.
- c. Overall Dimensions: 17 by 16 by 5 inches .
- d. Material: 18 gauge 20 gauge , Type 304 stainless steel.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
6. Support: Type II sink carrier .
7. Mounting Height: .

## 2.2 MANUALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Commercial Sink Faucets - Manual Type: Two-handle mixing , .
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard.
    - b. Elkay.
    - c. Zurn Industries, LLC.
  2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
  3. Standard: ASME A112.18.1/CSA B125.1.
  4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  5. Body Type: Centerset Widespread Single hole .
  6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
  7. Finish: Chrome plated Polished chrome plate .
  8. Maximum Flow Rate: 1.0 to 1.28 gpm 1.5 gpm .
  9. Mounting Type: Deck, concealed Deck, exposed Back/wall, exposed.
  10. Valve Handle(s): Lever .
  11. Spout Type: Rigid .
  12. Vacuum Breaker: Required for hose outlet.
  13. Spout Outlet: Aerator Laminar flow .

## 2.3 AUTOMATICALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Commercial Sink Faucets - Automatic Type: Hard-wired, electronic-sensor-operated, mixing , .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Moen Incorporated.
  - b. Sloan Valve Company.
  - c. Zurn Industries, LLC.
2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
4. 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.
5. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
6. Body Type: Centerset Single hole .
7. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
8. Finish: Chrome plated Polished chrome1 plate .
9. Maximum Flow Rate: 0.5 gpm .
10. Mounting Type: Deck Back/wall.
11. Spout Type: Rigid .
12. Spout Outlet: Aerator Laminar flow Spray .
13. Thermostatic Mixing Valve: Below deck, adjustable temperature manual side handle, with hot/cold water indicators, with check valves.
14. Control Module: Below deck, water-resistant module with internal flow setting switches.
15. Drain: Not part of faucet .

#### 2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key .
- F. Risers:
  1. NPS 3/8 NPS 1/2 .
  2. Chrome-plated, rigid-copper pipe .

#### 2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.

- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2.
  - 2. Material:
    - a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall ; and chrome-plated brass or steel wall flange.

## 2.6 SINK SUPPORTS

- A. Sink Carrier:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. WATTS.
    - b. Zurn Industries, LLC.
  - 2. Source Limitations: Obtain sink supports from single source from single manufacturer.
  - 3. Standard: ASME A112.6.1M.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install sinks level and plumb in accordance with rough-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with sink.
  - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.2 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.



- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### 3.3 ELECTRICAL CONNECTIONS

- A. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

### 3.4 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

## SECTION 224713 - DRINKING FOUNTAINS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes drinking fountains and related components.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountain.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include operating characteristics, and furnished specialties and accessories.

#### 1.3 CLOSEOUT SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 DRINKING FOUNTAINS

- A. Drinking Fountains : Stainless steel , wheelchair accessible, wall mounted.
  - 1. Stainless-Steel Drinking Fountains:
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      - 1) Elkay.
      - 2) Halsey Taylor.
      - 3) Oasis International.
  - 2. Standards:
    - a. Comply with ASME A112.19.3/CSA B45.4 ASME A112.19.2/CSA B45.1.
    - b. Comply with NSF 61 and NSF 372.
    - c. Comply with ICC A117.1.
  - 3. Type Receptor: Slab With back On horizontal support.
  - 4. Receptor Shape: Rectangular Round .
  - 5. Back Panel: Stainless-steel wall plate behind drinking fountain.
  - 6. Bubblers: One , with adjustable stream regulator, located on deck.
  - 7. Maximum Water Flow: 0.15 gpm 0.5 gpm .
  - 8. Control: Push button Push bar .
  - 9. Drain: Grid type with NPS 1-1/4 tailpiece.
  - 10. Supply: NPS 3/8 with shutoff valve.
  - 11. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
  - 12. Support: Type I water cooler carrier .

13. Drinking Fountain Mounting Height: Standard Handicapped/elderly according to ICC A117.1.

B. Bottle-Filling Station : Surface-mounted Recessed , vandal-resistant.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Elkay.
2. Standards:
  - a. Comply with ASME A112.19.3/CSA B45.4.
  - b. Comply with NSF 61 and NSF 372.
  - c. Comply with ICC A117.1.
3. Cabinet: All stainless steel Stainless steel/ABS combination.
4. Bottle Filler: Sensor activation . Fill rate 0.5 to 1.5 gpm .
5. Drain: Grid type with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
8. Support: Type I water cooler carrier .
9. Bottle-Filling Station Mounting Height: Standard .

## 2.2 SUPPORTS

A. Type I Water Cooler Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. MIFAB, Inc.
  - b. WATTS.
  - c. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Set pedestal drinking fountains on floor.

- C. Install recessed drinking fountains secured to wood blocking in wall construction.
- D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

### 3.5 CLEANING

- A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

## SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

#### 1.2 ACTION SUBMITTALS

#### 1.3 INFORMATIONAL SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anti-corrosion coated , with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Pipe Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

#### 2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Advance Products & Systems, Inc.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.
3. Sealing Elements: EPDM-rubber High-temperature-silicone Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel .
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. GE Construction Sealants; Momentive Performance Materials Inc.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. May National Associates, Inc.; a subsidiary of Sika Corporation.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls Above Grade:
    - a. Piping Smaller Than NPS 6 : Steel-pipe sleeves .
    - b. Piping NPS 6 and Larger: Steel-pipe sleeves .
  - 2. Exterior Concrete Walls Below Grade:
    - a. Piping Smaller Than : .

- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 and Larger: Steel-pipe sleeves with sleeve-seal system .
  - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

END OF SECTION 230517



## SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Escutcheons.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. BrassCraft Manufacturing Co.; a Masco company.
  2. Dearborn Brass.
  3. ProFlo; a Ferguson Enterprises, Inc. brand.

#### 2.2 ESCUTCHEONS

- A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece deep pattern.
    - b. Chrome-Plated Piping: One-piece with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece steel with polished, chrome-plated finish.

- d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
  - f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
  - h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge or split-plate, stamped steel with exposed-rivet hinge with polished, chrome-plated finish.
2. Escutcheons for Existing Piping to Remain:
- a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
  - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
  - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

END OF SECTION 230518

## SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Equipment supports.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

#### 1.4 QUALITY ASSURANCE

### PART 2 - PRODUCTS

#### 2.1 METAL PIPE HANGERS AND SUPPORTS

##### A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .

#### 2.2 TRAPEZE PIPE HANGERS

- ##### A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.3 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

### 2.4 MATERIALS

- A. Carbon Steel: ASTM A1011/A1011M.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Fiberglass Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- E. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that 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 to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

### 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 bearing surface smooth.
- 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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.5 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 .

### 3.6 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

### 3.7 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 5. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

- L. 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. C-Clamps (MSS Type 23): For structural shapes.
  
- M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 230529



## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.

#### 1.2 ACTION SUBMITTALS

- A. Samples: For color, letter style, and graphic representation required for each identification material and device.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

##### A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Kolbi Pipe Marker Co.
  - c. Seton Identification Products; a Brady Corporation company.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White .
4. Background Color: Black .
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. Kolbi Pipe Marker Co.
  - 3. Seton Identification Products; a Brady Corporation company.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

## 2.3 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. Kolbi Pipe Marker Co.
  - 3. Seton Identification Products; a Brady Corporation company.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White .

- D. Background Color: Black .
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

#### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
  - 1. GEO SUPPLY AND RETURN PIPING: White letters on a safety-green background .

### 3.5 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue : For cold and hot-air supply ducts.
  - 2. Green : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
- C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:
  - a. Constant-volume air systems.
2. Testing, adjusting, and balancing of fuel oil systems for HVAC.
3. Testing, adjusting, and balancing of steam and condensate piping systems.
4. Testing, adjusting, and balancing of equipment.
5. Testing, adjusting, and balancing of existing HVAC systems and equipment.

#### 1.2 ACTION SUBMITTALS

#### 1.3 INFORMATIONAL SUBMITTALS

#### 1.4 QUALITY ASSURANCE

##### A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

##### B. TAB Specialists Qualifications, Certified by :

1. TAB Field Supervisor: Employee of the TAB specialist and certified by .
2. TAB Technician: Employee of the TAB specialist and certified by .

##### C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

##### D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

##### E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

#### 1.5 FIELD CONDITIONS

- ##### A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

- B. 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.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following available TAB specialists that may be engaged include, but are not limited to, the following:
  - 1. Thermal Balance .

### 3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.
- F. Examine equipment performance data, including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.

- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.
- L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
- Q. 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.

### 3.3 PREPARATION

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
  - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
  - b. Piping is complete with terminals installed.
  - c. Water treatment is complete.
  - d. Systems are flushed, filled, and air purged.
  - e. Strainers are pulled and cleaned.
  - f. Control valves are functioning in accordance with the sequence of operation.
  - g. Shutoff and balance valves have been verified to be 100 percent open.
  - h. Pumps are started and proper rotation is verified.
  - i. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
  - j. Variable-frequency controllers' startup is complete and safeties are verified.
  - k. Suitable access to balancing devices and equipment is provided.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
  1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
  4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.5 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

- A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
  1. Pumps.
  2. Fans and ventilators.



3. Air curtains.
4. Terminal units.
5. Commercial kitchen hoods.
6. Deaerators.
7. Furnaces.
8. Radiant heaters.
9. Unit heaters.
10. Solar collectors.
11. Heat exchangers.
12. Energy-recovery units.
13. Air-handling units.
14. Heating and ventilating units.
15. Rooftop air-conditioning units.
16. Heating-only makeup air units.
17. Dedicated outdoor-air units.
18. Packaged air conditioners.
19. Self-contained air conditioners.
20. Computer-room air conditioners.
21. Split-system air conditioners.
22. Variable-refrigerant-flow systems.
23. Heat pumps.
24. Valance heating and cooling units.
25. Chilled beams.
26. Coils.
27. Fan coil units.
28. Unit ventilators.
29. Radiators.
30. Convectors.
31. Finned-tube radiation heaters.
32. Radiant-heating cables piping and panels.
33. Humidifiers.
34. Dehumidification units.
35. .

### 3.6 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' Record drawings duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

### 3.7 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    - b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    - c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report artificial loading of filters at the time static pressures are measured.
  - 3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 4. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of submain and branch ducts.
  - 2. Adjust submain and branch duct volume dampers for specified airflow.
  - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

### 3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and equipment flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' Record drawings piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
1. Check expansion tank for proper setting.
  2. Check highest vent for adequate pressure.
  3. Check flow-control valves for proper position.
  4. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
  5. Verify that motor controllers are equipped with properly sized thermal protection.
  6. Check that air has been purged from the system.
- D. Measure and record upstream and downstream pressure of each piece of equipment.
- E. Measure and record upstream and downstream pressure of pressure-reducing valves.
- F. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
1. Check settings and operation of each safety valve. Record settings.

### 3.9 PROCEDURES FOR STEAM AND CONDENSATE SYSTEMS

- A. Measure and record upstream and downstream pressure of each piece of equipment.
- B. Measure and record upstream and downstream steam pressure of pressure-reducing valves.

- C. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
- D. Check settings and operation of each safety valve. Record settings.
- E. Verify the operation of each steam trap.

3.10 PROCEDURES FOR STEAM-TO-WATER HEAT EXCHANGERS

- A. Adjust and record water flow to within specified tolerances.
- B. Measure and record inlet and outlet water temperatures.
- C. Measure and record inlet steam pressure and condensate outlet pressure.
- D. Check and record settings and operation of safety and relief valves.

3.11 PROCEDURES FOR WATER-TO-WATER HEAT EXCHANGERS

- A. Adjust and record water flow to within specified tolerances.
- B. Measure and record inlet and outlet water temperatures.
- C. Measure and record pressure drop.
- D. Check and record settings and operation of safety and relief valves.

3.12 PROCEDURES FOR EXHAUST HOODS

- A. Room Pressure: Measure and record room pressure with respect to atmosphere and adjacent space with hoods in room initially not operating and then with hoods operating.
- B. Makeup Air: Systems supplying source of makeup air to hoods shall be in operation during testing and balancing of exhaust hoods.
  - 1. Measure and record temperature of makeup air entering hood. If hood makeup air is from multiple sources having different temperatures, measure and record the airflow and temperatures of each source and calculate the weighted average temperature.
  - 2. Use simulated smoke to observe supply air-distribution air patterns in vicinity of hoods. Consult with hood manufacturer and report conditions that have a detrimental effect on intended capture, containment, and other attributes effecting proper operation.
- C. Rooms with Multiple Hoods: Test each hood separately, one at a time, and repeat tests with all hoods intended to operate simultaneously by design.
- D. Canopy Hoods: Measure and record the following:
  - 1. Pressure drop across hood.

2. Airflow by duct traverse where duct distribution will allow accurate measurement, and calculate hood average face velocity.
3. Measure velocity across hood face and calculate hood airflow.
  - a. Clearly indicate the direction of flow at each point of measurement.
  - b. Measure velocity across opening on not less than 12-inch centers. Record velocity at each measurement, and calculate average velocity.
4. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.

E. Laboratory Fume Hoods: Measure and record the following:

1. Pressure drop across hood.
2. Airflow by duct traverse where duct distribution will allow accurate measurement, and calculate hood average face velocity. If hood is connected to exhaust duct distribution through an exhaust device with integral airflow measurement, that reading may be used in lieu of a duct traverse.
3. Face velocity across open hood face and calculate hood airflow.
  - a. Clearly indicate the direction of flow at each point of measurement.
  - b. Measure velocity across opening on not less than 6-inch centers. Record velocity at each measurement, and calculate average velocity.
4. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.
5. ASHRAE 110 Testing: With room and laboratory fume hood operating at design conditions, perform an "as-installed" performance test of the laboratory fume hood in accordance with ASHRAE 110. Test each indicate extent laboratory fume hood and document the test results.

F. Kitchen Hoods:

1. Type 1: Measure and record pressure drop and face velocity of hood filters and slots in accordance with hood manufacturer's instructions. Consult hood manufacturer to determine hood airflow using recorded information.
2. Type 2: Measure and record airflow by duct traverse.
3. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.

G. AHJ Tests: Conduct additional tests required by authorities having jurisdiction.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment with fan(s).
2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available.

3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
  4. Check the refrigerant charge.
  5. Check the condition of filters.
  6. Check the condition of coils.
  7. Check the operation of the drain pan and condensate-drain trap.
  8. Check bearings and other lubricated parts for proper lubrication.
  9. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:
1. New filters are installed.
  2. Coils are clean and fins combed.
  3. Drain pans are clean.
  4. Fans are clean.
  5. Bearings and other parts are properly lubricated.
  6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
  2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
  3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
  4. Balance each air outlet.

### 3.14 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.
  2. Air Outlets and Inlets: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.
  3. Heating-Water Flow Rate: Plus or minus 5 percent . If design value is less than 10 gpm, within 10 percent.
  4. Chilled-Water Flow Rate: Plus or minus 5 percent . If design value is less than 10 gpm, within 10 percent.
  5. Condenser-Water Flow Rate: Plus or minus 5 percent .

- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.15 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.16 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB specialist.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents, including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans performance forms, including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Heating coil, dry-bulb conditions.
    - e. Face and bypass damper settings at coils.
    - f. Fan drive settings, including settings and percentage of maximum pitch diameter.
    - g. Variable-frequency controller settings for variable-air-volume systems.
    - h. Settings for pressure controller(s).
    - i. Other system operating conditions that affect performance.
  16. Test conditions for pump performance forms, including the following:
    - a. Variable-frequency controller settings for variable-flow hydronic systems.
    - b. Settings for pressure controller(s).
    - c. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. 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.
- E. Air-Handling-Unit Test Reports: For air-handling units, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and speed.



- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan speed.
  - d. Inlet and discharge static pressure in inches wg.
  - e. For each filter bank, filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
  - j. Outdoor airflow in cfm.
  - k. Return airflow in cfm.
  - l. Outdoor-air damper position.
  - m. Return-air damper position.
  - n. Vortex damper position.

F. 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 o.c.
  - f. Make and model number.
  - g. Face area in sq. ft..
  - h. Tube size in NPS.
  - i. Tube and fin materials.
  - j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
  - a. Airflow rate in cfm.
  - b. Average face velocity in fpm.
  - c. Air pressure drop in inches wg.
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
  - e. Return-air, wet- and dry-bulb temperatures in deg F.
  - f. Entering-air, wet- and dry-bulb temperatures in deg F.
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
  - h. Water flow rate in gpm.
  - i. Water pressure differential in feet of head or psig.
  - j. Entering-water temperature in deg F.
  - k. Leaving-water temperature in deg F.
  - l. Refrigerant expansion valve and refrigerant types.
  - m. Refrigerant suction pressure in psig.
  - n. Refrigerant suction temperature in deg F.
  - o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:
  - a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Fuel type in input data.
  - g. Output capacity in Btu/h.
  - h. Ignition type.
  - i. Burner-control types.
  - j. Motor horsepower and speed.
  - k. Motor volts, phase, and hertz.
  - l. Motor full-load amperage and service factor.
  - m. Sheave make, size in inches, and bore.
  - n. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Entering-air temperature in deg F.
  - c. Leaving-air temperature in deg F.
  - d. Air temperature differential in deg F.
  - e. Entering-air static pressure in inches wg.
  - f. Leaving-air static pressure in inches wg.
  - g. Air static-pressure differential in inches wg.
  - h. Low-fire fuel input in Btu/h.
  - i. High-fire fuel input in Btu/h.
  - j. Manifold pressure in psig.
  - k. High-temperature-limit setting in deg F.
  - l. Operating set point in Btu/h.
  - m. Motor voltage at each connection.
  - n. Motor amperage for each phase.
  - o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:
  - a. System identification.
  - b. Location.
  - c. Coil identification.
  - d. Capacity in Btu/h.
  - e. Number of stages.
  - f. Connected volts, phase, and hertz.
  - g. Rated amperage.
  - h. Airflow rate in cfm.
  - i. Face area in sq. ft..
  - j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
  - a. Heat output in Btu/h.

- b. Airflow rate in cfm.
  - c. Air velocity in fpm.
  - d. Entering-air temperature in deg F.
  - e. Leaving-air temperature in deg F.
  - f. Voltage at each connection.
  - g. Amperage for each phase.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and speed.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan speed.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
    - a. System fan and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- K. Air-Terminal-Device Reports:

1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary airflow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final airflow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg F.
- L. 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.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
- M. 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 number and serial number.
    - f. Water flow rate in gpm.
    - g. Water pressure differential in feet of head or psig.
    - h. Required net positive suction head in feet of head or psig.
    - i. Pump speed.
    - j. Impeller diameter in inches.
    - k. Motor make and frame size.
    - l. 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.
  - b. Pump shutoff pressure in feet of head or psig.
  - c. Actual impeller size in inches.
  - d. Full-open flow rate in gpm.
  - e. Full-open pressure in feet of head or psig.
  - f. Final discharge pressure in feet of head or psig.
  - g. Final suction pressure in feet of head or psig.
  - h. Final total pressure in feet of head or psig.
  - i. Final water flow rate in gpm.
  - j. Voltage at each connection.
  - k. Amperage for each phase.

N. Instrument Calibration Reports:

- 1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.17 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager .
- B. Architect Owner Construction Manager Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 20 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.
- E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.

2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

### 3.18 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

## SECTION 230713 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.

#### 1.2 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).

#### 1.3 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.

#### 1.4 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. 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. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Owens Corning.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Owens Corning.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Owens Corning.

## 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.



- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. 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. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller Construction Products.
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. The Dow Chemical Company.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches . Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

### 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches .
      5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
      6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
      7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches , space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches .
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

### 3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
  - B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
  - C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
  - D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return located in unconditioned space.
  4. Indoor, exposed return located in unconditioned space.
- B. Items Not Insulated:
  1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  2. Factory-insulated flexible ducts.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, rectangular, supply-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- E. Concealed, rectangular, return-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- F. Concealed, rectangular, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- G. Exposed, round and flat-oval, supply-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- H. Exposed, round and flat-oval, return-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- I. Exposed, round and flat-oval, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- J. Exposed, rectangular, supply-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- K. Exposed, rectangular, return-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- L. Exposed, rectangular, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Ducts and Plenums, Exposed:
  - 1. None.
  - 2. PVC : 20 mils thick.
  - 3. .

END OF SECTION 230713

## SECTION 230719 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors .
2. Refrigerant suction and hot-gas piping, indoors and outdoors.
3. Geo thermal piping, indoors outdoors.

#### 1.2 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).

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

#### 1.4 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. Preference will be given to those who have successfully completed a manufacturer's installation training program, such as the 'Armacell Qualified Installer Program' (AQIP) or similar.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.



1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Grade 1, Type I for tubular materials.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armacell LLC; AP Armaflex or AP Armaflex Black LapSeal or a comparable product by one of the following:
  - a. Aeroflex USA, Inc.
  - b. K-Flex USA.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Grade 1, Type I for tubular materials.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Armacell LLC; UT Solaflex or a comparable product by one of the following:
    - a. Aeroflex USA, Inc.
    - b. K-Flex USA.

## 2.2 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Airex Manufacturing.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. P.I.C. Plastics, Inc.
    - d. Proto Corporation.
    - e. Speedline Corporation.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White Color-code jackets based on system. Color as selected by Architect.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.
- D. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. ITW Insulation Systems; Illinois Tool Works, Inc.
- E. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. 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 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 applies to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

- unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of 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 services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Installation shall follow the manufacturer's installation instructions or ASTM C 1710.

B. Insulation Installation on Straight Pipes and Tubes:

1. Slit tubular sections and apply onto piping or tubing. Alternatively, slide un-slit sections over the open ends of piping or tubing.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation must be installed in compression to allow for expansion and contraction.
4. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
5. For below-ambient systems, adhere the insulation to the pipe at least every 18 feet using manufacturer's adhesive. Completely terminate joints at critical points such as flanges, T-sections, elbows, supports, and similar fittings.

C. Insulation Installation on Pipe Flanges:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. Install pipe insulation to outer diameter of pipe flange.
3. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
4. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
5. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.



- D. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. Install mitered sections of pipe insulation.
  3. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

- E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
  2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
  3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
  4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
  5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Polyolefin: 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Polyolefin: 1 inch thick.
- C. Refrigerant Suction and Hot-Gas Flexible Tubing:
1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Polyolefin: 1 inch thick.
- D. Dual-Service Heating and Cooling, 40 to 200 Deg F:
1. NPS 10 and Smaller: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch ]
    - b. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
- D. Piping, Exposed:
  - 1. PVC PVC, Color-Coded by System : 20 mils thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. PVC: 40 mils thick.

3.12 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

## SECTION 230923 – HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS / GENERAL

- A. Drawings and general provisions of the Contract, SEE SCHEDULE ON MECHANICAL SHEETS.
- B. Complete new Campus wide HVAC control system to access all schools within this project for multiple locations.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. DDC system for monitoring and controlling of HVAC systems.
  - 2. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product include the following:
  - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
  - 3. Product description with complete technical data, performance curves, and product specification sheets.
  - 4. Installation, operation and maintenance instructions including factors effecting performance.
  - 5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
    - a. Workstations.
    - b. Servers.
    - c. Gateways.
    - d. Routers.
    - e. Protocol analyzers.
    - f. DDC controllers.
    - g. Enclosures.
    - h. Electrical power devices.
    - i. UPS units.

- j. Accessories.
- k. Instruments.
- l. Control dampers and actuators.
- m. Control valves and actuators.

B. Software Submittal:

- 1. Description and technical data of all software provided, and cross-referenced to products in which software will be installed.
- 2. Operating system software, operator interface and programming software, color graphic software, DDC controller software, maintenance management software, and third-party software.
- 3. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
- 4. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

C. Shop Drawings:

- 1. General Requirements:
  - a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
  - b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
- 2. Include plans, elevations, sections, and mounting details where applicable.
- 3. Plan Drawings indicating the following:
  - a. Room names and numbers with coordinated placement to avoid interference with control products indicated.
  - b. Each desktop workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
  - c. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
  - d. Network communication cable and raceway routing.
  - e. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.
- 4. Schematic drawings for each controlled HVAC system indicating the following:
  - a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
  - b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
  - c. A graphic showing location of control I/O in proper relationship to HVAC system.
  - d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
  - e. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays, and interface to DDC controllers.
  - f. Narrative sequence of operation.
  - g. Graphic sequence of operation, showing all inputs and output logical blocks.
- 5. DDC system network riser diagram indicating the following:

- a. Each device connected to network with unique identification for each.
  - b. Interconnection of each different network in DDC system.
  - c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or optical fiber cable type. Indicate raceway type and size for each.
6. Color graphics indicating the following:
- a. Itemized list of color graphic displays to be provided.
  - b. For each display screen to be provided, a true color copy showing layout of pictures, graphics, and data displayed.

#### 1.4 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.
1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
  2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
    - a. Install updates only after receiving Owner's written authorization.
  3. Warranty service shall occur during normal business hours and commence within 16 hours of Owner's warranty service request.
  4. Warranty Period: Two year(s) from date of Substantial Completion.
    - a. For Gateway: Two -year parts and labor warranty for each.

### PART 2 - PRODUCTS

#### 2.1 DDC SYSTEM MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alerton Inc.
  2. Automated Logic Corporation.
  3. Reliable Controls Corporation.

#### 2.2 DDC SYSTEM DESCRIPTION

- A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers , other network devices, operator interfaces, and software.
- 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.

## 2.3 WEB ACCESS

- A. DDC system shall be web based .
  - 1. Web-Based Access to DDC System:
    - a. DDC system software shall be based on server thin-client architecture, designed around open standards of web technology. DDC system server shall be accessed using a web browser over DDC system network, using Owner's LAN, and remotely over Internet through Owner's LAN.
    - b. Intent of thin-client architecture is to provide operators complete access to DDC system via a web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
    - c. Web access shall be password protected.

## 2.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design, Qualified Professional: Engage a qualified professional to design DDC system to satisfy requirements indicated.
  - 1. System Performance Objectives:
    - a. DDC system shall manage HVAC systems.
    - b. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
    - c. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
    - d. DDC system shall operate while unattended by an operator and through operator interaction.
    - e. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.

## 2.5 SYSTEM ARCHITECTURE

- A. System architecture shall consist of no more than two levels of LANs.
  - 1. Level one LAN shall connect network controllers and operator workstations.
  - 2. Level one or Level two LAN shall connect programmable application controllers to other programmable application controllers, and to network controllers.
  - 3. Level two or Level three LAN shall connect application-specific controllers to programmable application controllers and network controllers.
  - 4. Level two or Level three LAN shall connect application-specific controllers to application-specific controllers.

## 2.6 DDC SYSTEM OPERATOR INTERFACES

- A. Operator Means of System Access: Operator shall be able to access entire DDC system through any of multiple means, including, but not limited to, the following:

1. Desktop and portable workstation with hardwired connection through LAN port.
2. Remote connection through web access.

B. Desktop Workstations:

1. Connect to DDC system Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
2. Able to communicate with any device located on any DDC system LAN.

## 2.7 NETWORK COMMUNICATION PROTOCOL

- A. Network communication protocol(s) used throughout entire DDC system shall be open to Owner and available to other companies for use in making future modifications to DDC system.

## 2.8 DESKTOP WORKSTATIONS

- A. Description: A tower or all-in-one computer designed for normal use at a single, semipermanent location.

B. CONNECT TO EXISTING

## 2.9 SYSTEM SOFTWARE

A. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator. Include at least five levels with the penetration path operator assignable (for example, site, building, floor, air-handling unit, and supply temperature loop). Native language descriptors assigned to menu items are to be operator defined and modifiable under password control.
2. Include a hierarchical-linked dynamic graphic operator interface for accessing and displaying system data and commanding and modifying equipment operation. Interface shall use a pointing device with pull-down or penetrating menus, color and animation to facilitate operator understanding of system.
3. Descriptors for graphics, points, alarms and such shall be modified through operator's workstation under password control.
4. Use color, rotation, or other highly visible means, to denote status and alarm states. Color shall be variable for each class of points, as chosen by operator.

B. Reports and Logs:

1. Include reporting software package that allows operator to select, modify, or create reports using DDC system I/O point data available.
2. Each report shall be definable as to data content, format, interval and date.
3. Report data shall be sampled and stored on DDC controller, within storage limits of DDC controller, and then uploaded to archive on workstation server for historical reporting.
4. Operator shall be able to obtain real-time logs of all I/O points by type or status, such as alarm, point lockout, or normal.



- C. Standard Reports: Standard DDC system reports shall be provided and operator shall be able to customize reports later.
  - 1. Logs:
    - a. Alarm history.
    - b. System messages.
    - c. System events.
    - d. Trends.
- D. Custom Reports: Operator shall be able to easily define any system data into a daily, weekly, monthly, or annual report. Reports shall be time and date stamped and shall contain a report title.
- E. Standard Trends:
  - 1. Trend all I/O point present values, set points, and other parameters indicated for trending.
  - 2. Trends shall be associated into groups, and a trend report shall be set up for each group.
  - 3. Trends shall be stored within DDC controller and uploaded to hard drives automatically on reaching 75 of DDC controller buffer limit, or by operator request, or by archiving time schedule.
- F. Custom Trends: Operator shall be able to define a custom trend log for any I/O point in DDC system.

#### 2.10 ASHRAE 135 GATEWAYS

- A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable. BACnet-controlled plant equipment includes, but is not limited to, boilers, chillers, vrf eqpt and variable-speed drives.
- B. Gateway Minimum Requirements:
  - 1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.
  - 2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
  - 3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
  - 4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs according to ASHRAE 135.
  - 5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
  - 6. Backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

#### 2.11 DDC CONTROLLERS

- A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.

- B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.
- C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.
- D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.
- E. Input and Output Point Interface:
  - 1. Hardwired input and output points shall connect to network, programmable application and application-specific controllers.
  - 2. Input and output points shall be protected so shorting of point to itself, to another point, or to ground will not damage controller.
  - 3. Input and output points shall be protected from voltage up to 24 V of any duration so that contact will not damage controller.

## 2.12 NETWORK CONTROLLERS

- A. General Network Controller Requirements:
  - 1. Include adequate number of controllers to achieve performance indicated.
  - 2. System shall consist of one or more independent, standalone, microprocessor-based network controllers to manage global strategies indicated.
  - 3. Controller shall have enough memory to support its operating system, database, and programming requirements.
  - 4. Data shall be shared between networked controllers and other network devices.
  - 5. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
  - 6. Controllers that perform scheduling shall have a real-time clock.
  - 7. Controllers shall be fully programmable.
- B. Communication:
  - 1. Network controllers shall communicate with other devices on DDC system Level one network.
  - 2. Network controller also shall perform routing if connected to a network of programmable application and application-specific controllers.
- C. Operator Interface:
  - 1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation or mobile device.

## 2.13 PROGRAMMABLE APPLICATION CONTROLLERS

- A. General Programmable Application Controller Requirements:

1. Include adequate number of controllers to achieve performance indicated.
2. Controller shall have enough memory to support its operating system, database, and programming requirements.
3. Data shall be shared between networked controllers and other network devices.
4. Operating system of controller shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling shall have a real-time clock.
6. Controller shall continually check status of its processor and memory circuits. If an abnormal operation is detected, controller shall assume a predetermined failure mode and generate an alarm notification.
7. Controllers shall be fully programmable.

B. Operator Interface:

1. Controller shall be equipped with a service communications port for connection to a portable operator's workstation or mobile device.

2.14 CONTROL WIRE AND CABLE

A. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Cable shall be balanced twisted pair.
2. Comply with the following requirements and for balanced twisted pair cable described in
  - a. Cable shall be plenum rated.
  - b. Cable shall have a unique color that is different from other cables used on Project.

2.15 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:

1. Self-adhesive label bearing unique identification.
  - a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.
2. Legend shall consist of white lettering on black background.
3. Laminated acrylic or melamine plastic sign shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer and shall be fastened with drive pins.
4. Instruments, control devices, and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

### PART 3 - EXECUTION

#### 3.1 DDC SYSTEM INTERFACE WITH OTHER SYSTEMS AND EQUIPMENT

##### A. Communication Interface to Equipment with Integral Controls:

1. DDC system shall have communication interface with equipment having integral controls and having a communication interface for remote monitoring or control.
2. Equipment to Be Connected:
  - a. Dedicated outdoor-air units specified in Section 237433 "Dedicated Outdoor-Air Units."
  - b. Variable-frequency controllers specified in Section 262923 "Variable-Frequency Motor Controllers."
  - c. VRF Equipment .

##### B. Communication Interface to Other Building Systems:

1. DDC system shall have a communication interface with systems having a communication interface.
2. Systems to Be Connected:
  - a. Lighting controls specified in Section 260943.23 "Relay-Based Lighting Controls."
  - b. Fire-alarm system specified in Section 284621.11 "Addressable Fire-Alarm Systems."
  - c. Access controls specified in Section 281300 "Access Control System Software and Database Management."
  - d. .

#### 3.2 DDC SYSTEM INTERFACE WITH EXISTING SYSTEMS

##### A. Interface with Existing Systems:

1. DDC systems shall interface existing systems to achieve integration.

#### 3.3 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- ##### A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

#### 3.4 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

- D. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."
- E. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

### 3.5 WORKSTATION INSTALLATION

#### A. Desktop Workstations Installation:

- 1. Install workstation(s) at location(s) directed by Owner.
- 2. Develop Project-specific graphics, trends, reports, logs and historical database.

#### B. Color Graphics Application:

- 1. Use system schematics indicated as starting point to create graphics.
- 2. Develop Project-specific library of symbols for representing system equipment and products.
- 3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
- 4. Submit sketch of graphic layout with description of all text for each graphic for Owner's and Architect's review before creating graphic using graphics software.
- 5. Seek Owner input in graphics development once using graphics software.
- 6. Final editing shall be done on-site with Owner's review and feedback.
- 7. Refine graphics as necessary for Owner acceptance.
- 8. On receiving Owner acceptance, print a hard copy for inclusion in operation and maintenance manual. Prepare a scanned copy PDF file of each graphic and include with softcopy of DDC system operation and maintenance manual.

### 3.6 ENCLOSURES INSTALLATION

#### A. Install the following items in enclosures, to comply with indicated requirements:

- 1. Gateways.
- 2. Routers.
- 3. Controllers.
- 4. Electrical power devices.
- 5. UPS units.
- 6. Relays.
- 7. Accessories.
- 8. Instruments.
- 9. Actuators

#### B. Attach wall-mounted enclosures to wall using the following types of steel struts:

- 1. For NEMA 250, Type 1 Enclosures: Use painted steel strut and hardware.
- 2. For NEMA 250, Type 4 Enclosures and Enclosures Located Outdoors: Use stainless steel strut and hardware.

3. Install plastic caps on exposed cut edges of strut.

C. Align bottom of adjacent enclosures.

D. Install floor-mounted enclosures located in mechanical equipment rooms on concrete housekeeping pads. Attach enclosure legs using galvanized- or stainlesssteel anchors.

### 3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification products and installation.

B. Install self-adhesive labels laminated acrylic or melamine plastic signs with unique identification on face for each of the following:

1. Operator workstation.
2. Server.
3. Printer.
4. Router.
5. Protocol analyzer.
6. DDC controller.
7. Enclosure.
8. Electrical power device.
9. UPS unit.
10. Accessory.

C. Install unique instrument identification on face of each instrument connected to a DDC controller.

D. Install unique identification on face of each control damper and valve actuator connected to a DDC controller.

E. Where product is installed above accessible tile ceiling, also install matching identification on face of ceiling grid located directly below.

F. Where product is installed above an inaccessible ceiling, also install identification on face of access door directly below.

G. Warning Labels and Signs:

1. Shall be permanently attached to equipment that can be automatically started by DDC control system.
2. Shall be located in highly visible location near power service entry points.

### 3.8 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

### 3.9 DDC SYSTEM CONTROLLER CHECKOUT

- A. Verify power supply.
  - 1. Verify voltage, phase and hertz.
  - 2. Verify that protection from power surges is installed and functioning.
  - 3. Verify that ground fault protection is installed.
  - 4. If applicable, verify if connected to UPS unit.
  - 5. If applicable, verify if connected to a backup power source.
  - 6. If applicable, verify that power conditioning units, transient voltage suppression and high-frequency noise filter units are installed.
- B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.
- C. Verify that spare I/O capacity is provided.

### 3.10 DDC CONTROLLER I/O CONTROL LOOP TESTS

- A. Testing:
  - 1. Test every I/O point connected to DDC controller to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
  - 2. Test every I/O point throughout its full operating range.
  - 3. Test every control loop to verify operation is stable and accurate.
  - 4. Adjust control loop proportional, integral and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
  - 5. Test and adjust every control loop for proper operation according to sequence of operation.
  - 6. Test software and hardware interlocks for proper operation. Correct deficiencies.
  - 7. Operate each analog point at the following:
    - a. Upper quarter of range.
    - b. Lower quarter of range.
    - c. At midpoint of range.
  - 8. Exercise each binary point.
  - 9. For every I/O point in DDC system, read and record each value at operator workstation, at DDC controller and at field instrument simultaneously. Value displayed at operator workstation, at DDC controller and at field instrument shall match.
  - 10. Prepare and submit a report documenting results for each I/O point in DDC system and include in each I/O point a description of corrective measures and adjustments made to achieve desired results.

### 3.11 DDC SYSTEM VALIDATION TESTS

- A. Perform validation tests before requesting final review of system. Before beginning testing, first submit Pretest Checklist and Test Plan.
- B. After approval of Test Plan, execute all tests and procedures indicated in plan.

- C. After testing is complete, submit completed test checklist.
- D. Pretest Checklist: Submit the following list with items checked off once verified:
  - 1. Detailed explanation for any items that are not completed or verified.
  - 2. Required mechanical installation work is successfully completed and HVAC equipment is working correctly.
  - 3. HVAC equipment motors operate below full-load amperage ratings.
  - 4. Required DDC system components, wiring, and accessories are installed.
  - 5. Installed DDC system architecture matches approved Drawings.
  - 6. Control electric power circuits operate at proper voltage and are free from faults.
  - 7. Required surge protection is installed.
  - 8. DDC system network communications function properly, including uploading and downloading programming changes.
  - 9. Using BACnet protocol analyzer, verify that communications are error free.
  - 10. Each controller's programming is backed up.
  - 11. Equipment, products, tubing, wiring cable, and conduits are properly labeled.
  - 12. All I/O points are programmed into controllers.
  - 13. Testing, adjusting, and balancing work affecting controls is complete.
  - 14. Dampers and actuators zero and span adjustments are set properly.
  - 15. Each control damper and actuator goes to failed position on loss of power.
  - 16. Valves and actuators zero and span adjustments are set properly.
  - 17. Each control valve and actuator goes to failed position on loss of power.
  - 18. Meter, sensor and transmitter readings are accurate and calibrated.
  - 19. Control loops are tuned for smooth and stable operation.
  - 20. View trend data where applicable.
  - 21. Each controller works properly in standalone mode.
  - 22. Safety controls and devices function properly.
  - 23. Interfaces with fire-alarm system function properly.
  - 24. Electrical interlocks function properly.
  - 25. Operator workstations and other interfaces are delivered, all system and database software is installed, and graphic are created.
  - 26. Record Drawings are completed.
- E. Validation Test:
  - 1. Verify operating performance of each I/O point in DDC system.
    - a. Verify analog I/O points at operating value.
    - b. Make adjustments to out-of-tolerance I/O points.
      - 1) Identify I/O points for future reference.
      - 2) Simulate abnormal conditions to demonstrate proper function of safety devices.
      - 3) Replace instruments and controllers that cannot maintain performance indicated after adjustments.
  - 2. Simulate conditions to demonstrate proper sequence of control.
  - 3. Readjust settings to design values and observe ability of DDC system to establish desired conditions.
  - 4. After 24 Hours following Initial Validation Test:
    - a. Re-check I/O points that required corrections during initial test.
    - b. Identify I/O points that still require additional correction and make corrections necessary to achieve desired results.



5. After 24 Hours of Second Validation Test:
  - a. Re-check I/O points that required corrections during second test.
  - b. Continue validation testing until I/O point is normal on two consecutive tests.
6. Completely check out, calibrate, and test all connected hardware and software to ensure that DDC system performs according to requirements indicated.
7. After validation testing is complete, prepare and submit a report indicating all I/O points that required correction and how many validation re-tests it took to pass. Identify adjustments made for each test and indicate instruments that were replaced.

### 3.12 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.
- B. Extent of Training:
  1. Base extent of training on scope and complexity of DDC system indicated and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
  2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.

END OF SECTION 230923

## SECTION 231123 - 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 and tubing joining materials.
  - 3. Manual gas shutoff valves.
  - 4. Pressure regulators.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 3. Pressure regulators. Indicate pressure ratings and capacities.

#### 1.4 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 Architect Construction Manager 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 Construction Manager's written permission.

#### 1.5 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 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 65 psig 100 psig minimum unless otherwise indicated.
  - 3. Minimum Operating Pressure of Service Meter: 5 psig .
- B. Natural-Gas System Pressure within Buildings: 0.5 psig or less .

### 2.2 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. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

### 2.3 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig .
  - 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 and smaller.
  6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig .
  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.
- C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. A.Y. McDonald Mfg. Co.
    - b. Apollo Flow Controls; Conbraco Industries, Inc.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated brass.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Separate packnut with adjustable-stem packing threaded ends.
  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.
  9. Listing: Valves NPS 1 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.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. A.Y. McDonald Mfg. Co.
    - b. Apollo Flow Controls; Conbraco Industries, Inc.
  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.
  9. Listing: Valves NPS 1 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. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. A.Y. McDonald Mfg. Co.
  - b. Apollo Flow Controls; Conbraco Industries, Inc.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
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.
9. Listing: Valves NPS 1 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.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. A.Y. McDonald 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.
7. Listing: Valves NPS 1 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.

G. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. A.Y. McDonald Mfg. Co.
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.
9. Listing: Valves NPS 1 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.

H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. A.Y. McDonald Mfg. Co.
  - b. Milliken Valve Company.
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.
9. Listing: Valves NPS 1 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.

I. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Kerotest Manufacturing Corp.
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 .
8. Operating Temperature: Minus 20 to plus 140 deg F .
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.

J. 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 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.

## 2.4 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

- B. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Actaris.
    - b. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
    - c. Itron Gas.
    - d. Maxitrol Company.
    - e. Richards Industries.
  2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  3. Springs: Zinc-plated steel; interchangeable.
  4. Diaphragm Plate: Zinc-plated steel.
  5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  6. Orifice: Aluminum; interchangeable.
  7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  11. Maximum Inlet Pressure: 10 psig .

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 the International Fuel Gas Code requirements for prevention of accidental ignition.

#### 3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 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 piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Verify final equipment locations for roughing-in.
- K. 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 long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- L. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- M. 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.
- N. Connect branch piping from top or side of horizontal piping.
- O. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- P. Do not use natural-gas piping as grounding electrode.
- Q. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."



### 3.3 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.

### 3.4 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. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. 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.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. 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 steel piping , with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.6 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 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.

### 3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

### 3.8 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

### 3.9 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full -port, bronze ball valves with bronze trim.

- B. Valves in branch piping for single appliance shall be the following:

1. Two-piece, full -port, bronze ball valves with bronze trim.

END OF SECTION 231123

## SECTION 232116 - HYDRONIC PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Hydronic specialty valves.
  2. Air-control devices.
  3. Strainers.
  4. Connectors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product:
1. Include construction details and material descriptions for hydronic piping specialties.
  2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
  3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

#### 1.3 CLOSEOUT SUBMITTALS

#### 1.4 QUALITY ASSURANCE

- A. 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 1.

### PART 2 - PRODUCTS

#### 2.1 HYDRONIC SPECIALTY VALVES

- A. Bronze, Calibrated-Orifice, Balancing Valves:
1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  2. Ball: Brass or stainless steel.
  3. Plug: Resin.
  4. Seat: PTFE.
  5. End Connections: Threaded or socket.
  6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  7. Handle Style: Lever, with memory stop to retain set position.

8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.

## 2.2 AIR-CONTROL DEVICES

### A. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

## 2.3 STRAINERS

### A. Y-Pattern Strainers:

1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20 60-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

## 2.4 CONNECTORS

### A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 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 check valves at each pump discharge and elsewhere as required to control flow direction.
- C. 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; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

- D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

### 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

END OF SECTION 232116

## SECTION 232123 - HYDRONIC PUMPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Base-mounted, end-suction centrifugal pumps.

#### 1.2 DEFINITIONS

- A. ECM: Electronically commutated motor.
- B. EPDM: Ethylene propylene diene monomer.
- C. EPR: Ethylene propylene rubber.
- D. FKM: Fluoroelastomer polymer.
- E. HI: Hydraulic Institute.
- F. NBR: Nitrile rubber or Buna-N.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
1. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated.
  2. Indicate pump's operating point on curves.

#### 1.4 INFORMATIONAL SUBMITTALS

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps 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. Mechanical Seals: One mechanical seal(s) for each pump.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation.

### 2.2 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

- A. Source Limitations: Obtain pumps from single source from single manufacturer.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump with flexible shaft coupling designed for base mounting, with pump and motor shafts horizontal.
- C. Pump Construction:
  1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gauge tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing, and provide attached piping to allow removal and replacement of impeller without disconnecting piping or requiring realignment of pump and motor shaft.
  2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps that are not frequency-drive controlled, trim impeller to match specified performance.
  3. Pump Shaft: Carbon steel, with copper-alloy shaft sleeve .
  4. Seal, Mechanical Type: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and NBR EPDM FKM bellows and gasket.
  5. Seal, Packing Type: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
  6. Pump Bearings: Grease-lubricated ball bearings 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 EPDM coupling sleeve for variable-speed applications.
- 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 A36/A36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.



- G. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Enclosure: Totally enclosed, fan cooled .
  - 2. NEMA Premium Efficient motors as defined in NEMA MG 1.
  - 3. 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.
  - 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
  - 5. Variable-speed motor.
  - 6. Provide integral pump motor variable-speed controller.
  
- H. Capacities and Characteristics:
  - a. SEE SCHEDULES ON THE DRAWINGS

### 2.3 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser:
  - 1. Angle pattern.
  - 2. 175-psig pressure rating, cast -iron body and end cap, pump-inlet fitting.
  - 3. Bronze 16-mesh wire startup and bronze permanent strainers with 3/16-inch.
  - 4. Bronze straightening vanes.
  - 5. Drain plug.
  - 6. Factory-fabricated support.

### 2.4 INTEGRAL PUMP MOTOR VARIABLE-SPEED CONTROLLERS

- A. Where specified or scheduled, provide pumps with an integral pump motor speed controller.
  - 1. Motor: Operates as constant- or variable-speed pump with speed regulated by an integrated variable-speed drive.
  - 2. Integrated Pump Controller: Supports direct communication with the building management system (BMS) with built-in support for the following protocols: BACnet? MS/TP .
  - 3. Commissioning and pump set up access to pump controls via the following:
    - a. A web interface (data exchange).
    - b. A user interface located on the face of speed controller to adjust modes and mode values.
    - c. An electronic display that reads real-time mode set values, flow, head, speed, and power and that locks out unauthorized adjustment of pump.
  - 4. Provide electronics with "Auto" as factory default but slope of the proportional curve will automatically match the required system curve, constant pressure control (delta-p/c), variable differential pressure control (delta-p/v), constant curve duty (uncontrolled pump), and rpm regulation. RPM (speed) regulation can be accomplished by the following:

- a. Manual (via user interface or HTML).
- b. Remote via 0 to 10 V dc.
- c. Data protocol communications with the BMS.
5. Pump Electronics: Standard with multiple digital inputs and one external digital output to be available for additional mechanical room control and pump status monitoring.
6. Controller: Mounted on or adjacent to the motor. Provide enclosure rated to UL Type 12.
7. Electronically Protected Pumps: Rated for continuous duty and with built-in startup circuit. Provide overcurrent, line surge and current limit protection, thermal monitoring, heat sink status and over temperature protection.
8. Pump capable of being monitored continuously via integrated Internet link.
9. Integrated pump controller system to have the following features:
  - a. Controller software shall be capable of sensorless control in variable-volume systems without need for pump-mounted (internal/external) or remotely mounted differential pressure sensor.
  - b. Integrated Pump Controller Sensorless Control: Operates under Quadratic Pressure Control (QPC) to ensure that head reduction with reducing flow conforms to quadratic control curve.
  - c. Controller:
    - 1) Minimum head of 40 percent of design duty head.
    - 2) User-adjustable control mode settings and minimum/maximum head set points using built-in programming interface.
  - d. Controller Integrated Control Software:
    - 1) Capable of controlling pump performance for non-overloading power at every point of operation.
    - 2) Capable of maintaining flow rate data.

### 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 the 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 will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PUMP INSTALLATION

- A. Install pumps to provide access for periodic maintenance including removing 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. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.
- D. Equipment Mounting:
  - 1. Install base-mounted 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 230548 "Vibration and Seismic Controls for HVAC."
  - 3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

### 3.3 ALIGNMENT

- A. Engage a factory-authorized service representative to perform alignment service.
- B. Comply with requirements in HI standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- 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.

### 3.4 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for 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, shutoff, and throttling valves triple-duty valve on discharge side of pumps.
- F. Install Y-type strainer suction diffuser and shutoff valve on suction side of pumps.
  - 1. Use startup strainer for initial system startup. Install permanent strainer element before turnover of system to Owner.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

- H. Install pressure gauges on pump suction and discharge or at integral pressure-gauge tapping, or install single gauge with multiple-input selector valve.
- I. Install check valve on each condensate pump unit discharge unless unit has a factory-installed check valve.

### 3.5 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. 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 high.

### 3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123

## **SECTION 232500 - CHEMICAL TREATMENT**

### **A. GENERAL**

1. Scope. this section outlines the general requirements for furnishing and installing chemical treatment for the various systems as specified below:

Closed Loop Systems (Individual bore holes for each classroom / mechanical room WSHP)  
After all chemical inserted, add 10% ethylene glycol solution for freeze protection in system.

### **B. CLOSED LOOP SYSTEMS**

1. Supply and install Guardian-IPSO Treatment Program, American Water Treatment, Kesco, Mogul, Dearborn, or Betz. All equipment, chemicals, and service to be supplied by and be the sole responsibility of a single water treatment company.
2. The water treatment supplier will be an established and reputable firm with not less than ten years previous experience in water treatment. The supplier's predominant business must be that of manufacturing, supplying, testing and servicing water treatment, with water analysis laboratory and full time personnel available to the owner.
3. Fill in system for 10% Glycol solution for anti-freeze protection.

### **C. WATER TREATMENT CHEMICALS**

1. Provide a one year supply of Guardian-IPCO water treatment chemicals for the prevention of corrosion in the closed recirculating system. All formulations must be compatible with system construction materials and meet or exceed all environmental requirements. Formulas will be supplied in liquid form in DOT approved containers.

### **D. TESTING**

1. The water treatment vendor will supply all testing equipment and reagents necessary to properly maintain the treatment program, and any additional equipment or reagents as specified for the bid.

**END OF SECTION 232500**

## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Sheet metal materials.
  - 3. Hangers and supports.

#### 1.2 DEFINITIONS

- A. OSHPD: Office of Statewide Health Planning and Development (State of California).

#### 1.3 ACTION SUBMITTALS

#### 1.4 INFORMATIONAL SUBMITTALS

#### 1.5 QUALITY ASSURANCE

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

## 2.2 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.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
  - 3.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 G90 .
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 G90 .

2. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- H. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

#### 2.4 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.



## 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 in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. 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.
- J. Install fire , combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
- M. Elbows: Use long-radius elbows wherever they fit.
  - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.

2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

### 3.2 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum

Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.5 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.6 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
  - 2. .
- B. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      - 4) Radius-to Diameter Ratio: 1.5.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches and Larger in Diameter: .

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Conical spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

## 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. Turning vanes.
3. Flexible connectors.
4. Duct accessory hardware.

- B. Related Requirements:

1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
2. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
3. Section 284621.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.
4. Section 284621.13 "Conventional Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

#### 1.3 ACTION SUBMITTALS

#### 1.4 INFORMATIONAL SUBMITTALS

#### 1.5 CLOSEOUT SUBMITTALS

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 90A and NFPA 90B.
- 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 MANUAL VOLUME DAMPERS

### A. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

### B. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

## 2.3 TURNING VANES

### A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Aero-Dyne Sound Control Co.
2. DynAir; a Carlisle Company.
3. Ward Industries; a brand of Hart & Cooley, Inc.

### B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

### C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

### D. Vane Construction:

1. Single wall.
2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.4 FLEXIBLE CONNECTORS

### A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. DynAir; a Carlisle Company.
2. Ward Industries; a brand of Hart & Cooley, Inc.

- B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Materials: Flame-retardant or noncombustible fabrics.
- E. Coatings and Adhesives: Comply with UL 181, Class 1.
- F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. .
  - 2. Tensile Strength: 480 lbf/inch in the warp and in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.5 DUCT ACCESSORY HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. DynAir; a Carlisle Company.
  - 2. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.6 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G60 G90 .
  2. Exposed-Surface Finish: Mill phosphatized.
- B. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- C. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
- E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.
  2. Install aluminum volume dampers in aluminum ducts.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
- H. Install fire and smoke dampers in accordance with UL listing.
- I. Install access doors with swing against duct static pressure.
- J. Install flexible connectors to connect ducts to equipment.



- K. Install duct test holes where required for testing and balancing purposes.

END OF SECTION 233300

## SECTION 233346 - FLEXIBLE 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. Insulated flexible ducts.

#### 1.3 ACTION SUBMITTALS

#### 1.4 INFORMATIONAL SUBMITTALS

### 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.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

#### 2.2 INSULATED FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flexmaster U.S.A., Inc.
  - 2. JP Lamborn Co.
  - 3. McGill AirFlow LLC.

4. Thermaflex; a Flex-Tek Group company.
- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
  1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 10 to plus 160 deg F.
  4. Insulation R-Value: Comply with ASHRAE/IES 90.1 .
- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; vapor-barrier film.
  1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 175 deg F.
  4. Insulation R-Value: Comply with ASHRAE/IES 90.1 .

## 2.3 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
- B. Non-Clamp Connectors: .

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install flexible ducts 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 in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- D. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- E. Connect flexible ducts to metal ducts with draw bands .
- F. Install duct test holes where required for testing and balancing purposes.
- G. Installation:
  1. Install ducts fully extended.
  2. Do not bend ducts across sharp corners.

3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

H. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

## SECTION 237401 – 4-PIPE UNIT VENTILATORS

### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. The contractor shall furnish and install packaged unit ventilator systems, of the capacities, performance, and configuration, as indicated in the unit schedule. Each unit shall be complete with factory furnished components and accessories as shown in the plans and as specified herein.
- B. Electrical work required as an integral part of the temperature control work is indicated on the mechanical drawings, and is the responsibility of the HVAC contractor to hire the services of a temperature control contractor and/or system integrator contractor to provide a complete system to perform the sequence of operation shown, or as described in this specification. The full sequence of operation must be provided and installed by this contractor for all trades.

#### 1.02 SUBMITTALS

- A. Submit schedule for all types, sizes and accessories. Schedule shall include certified performance data, room locations and all operating data.
- B. Submit shop drawings for all units including all dimensional information, construction details, installation details, required opening sizes, roughing locations for piping and electrical work and accessory equipment. Equipment must meet specifications. Where deviations from the specifications exist, they must be identified.
- C. Provide field wiring diagrams for all electrical power and temperature control field-wiring connections.
- D. Submittals shall also include complete operating and maintenance instruction manuals and unit specific replacement parts lists.

#### 1.03 QUALITY ASSURANCE

- A. Unit ventilators shall be listed by Underwriters Laboratories Inc. (U.L.) for the United States and Canada.
- B. Motors shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.
- C. Unit ventilation rate to be certified and tested per Air Conditioning and Refrigeration Institute (ARI) standard 840.
- D. Unit to be certified and labeled compliant with the seismic design provisions of the International Building Code (IBC) Chapter 16 and independent test agency requirements of Chapter 17.

### PART 2: PRODUCTS - Unit Ventilators

#### 2.01 Cabinet and Chassis:

- A. Unit frames shall be of unitized, welded construction, with structural elements aligned in an assembly jig prior to welding, to insure proper dimensions, rigidity, and squareness. Frames assembled with mechanical fasteners shall not be acceptable.
- B. Internal sheet metal parts shall be constructed of galvanized steel to inhibit corrosion.

C. Exterior cabinet panels shall be fabricated from furniture grade steel of not less than 16 gauge steel with no sharp edges and no unsightly screw heads and shall receive an electro-statically applied powder paint, and be oven baked with environmentally friendly thermosetting urethane powder finish to provide a high quality appearance. Finish color shall be as selected by Architect from manufacturer's standard colors.

D. The interior areas of the unit ventilator shall be insulated for sound attenuation and to provide protection against condensation of moisture on or within the unit. The unit shall be provided with an ultra-quiet sound package consisting of acoustically matched low speed fans to fan housing, sound barrier insulation material (non-fiberglass) adhered to the bottom underside of the unit top panel, sides of the fan section and sound absorbing insulation (non-fiberglass) material applied to the unit front panel.

E. Units shall be constructed so that testing and troubleshooting can be accomplished in the end pockets of operating units, without affecting the normal air flow patterns through the unit.

F. Each unit shall be provided with a non-fused power interrupt switch that disconnects the main power to the unit for servicing or when the unit is to be shut down for an extended period of time. The fan motor and controls shall have the hot line(s) protected by factory installed cartridge type fuse(s).

G. The manufacturer shall have published cataloged sound data available for the engineer's review. Sound data shall have been conducted using a qualified reverberant room per ANSI S1.31 and ANSI S12.32. Sound test data shall be based on standard cfm at standard air (fixed density of air at 70F) in accordance with ARI procedures based upon ARI 350. The engineer shall have the right to reject equipment not conforming to the specified manufacturer's sound data, as a minimum.

#### 2.02 Coils:

A. Coil assembly shall be of a modular construction so that it is removeable from the front of the unit.

B. All coils shall be installed in a draw through position to assure uniform air distribution over the full-face area of the coil, and an even unit discharge temperature.

C. All heating and cooling coils shall be constructed with copper tubes and mechanically bonded aluminum corrugated plate type fins. All coils shall have aluminum individual unshared fin surfaces. An air break shall exist between coils.

D. Water heating and cooling coils shall be furnished with a threaded drain plug at the lowest point and a manual air vent at the high point of the coil. A factory installed low temperature freeze-stat shall be provided on the leaving edge of the water heating coil in a wave-like configuration to sense multiple locations and shall react to possible freezing conditions. The unit-mounted controls shall incorporate this device.

#### 2.03 Drain Pan

A. All units (either heating only, heat/cool, cool only or reheat) shall come furnished with an insulated drain pan constructed of stainless steel. A drain outlet shall be provided on both ends of the drain pan with one outlet capped. The drain hand of connection shall be easily field-reversed by relocating the cap to the opposite end without disassembly of the unit or movement of the unit drain pan.

B. The drain pan shall be able to be sloped in either direction for proper condensate removal.

C. Drain shall be provided with a secondary, overflow drain connection on both ends of the pan.

#### 2.04 Fans and Motor:

- A. The fan and motor assembly shall be of a low speed design to assure maximum quietness and efficiency.
- B. Fans shall be double-inlet, forward-curved, centrifugal type with offset aerodynamic blades. Fans and shaft shall be statically and dynamically balanced as an assembly in the unit before shipment.
- C. Fan housings shall be constructed of galvanized steel incorporating logarithmic expansion for quiet operation. Fan and motor assembly shall be of the direct drive type. Belt drive fans shall not be allowed.
- D. Motors shall be 115 volt, single phase, 60Hz, ECM with auto reset internal thermal overload device designed specifically for unit ventilator operation. Motors shall be located out of the conditioned air stream.
- E. All components of the fan/motor assembly shall be removable from the top of floor-mounted units.
- F. Units shall have sleeve type motor and fan shaft bearings, and shall not require oiling more than annually. All bearings shall be located out of the airstream. Bearings in the air stream are not acceptable.
- G. ECM Motor speed shall be factory programmed for three (3) speeds, HIGH-MEDIUM-LOW-OFF (not accessible from the exterior of the unit). Fan motor shall have hot leg protected by a factory installed cartridge fuse.
- H. Fan shall be in the Draw Through position for motor reheat of supply air.

#### 2.05 Outdoor & Room Dampers:

- A. Each unit shall be provided with separate room air and outdoor air dampers.
- B. The room air damper shall be two-piece, double-wall construction fabricated from aluminum, and be counterbalanced against backpressure to close by gusts of wind pressure, thereby preventing outdoor air from blowing directly into the room.
- C. The outdoor air damper shall be two piece, double wall construction fabricated from galvanized steel, with ½" thick, 1½ lb. density glassfiber insulation encapsulated between the welded blade halves for rigidity and to inhibit corrosion. The outdoor air damper shall have additional foam insulation on the exterior surface damper blade and on the ends of the outdoor air chamber. A single blade damper, which can be twisted and will leak air, will not be considered.
- D. Dampers shall be fitted with blended mohair seals along all sealing edges. Pressure adhesive sponge neoprene or plastic clip-on brush type sealers for damper seals are not acceptable. Rubber type gasket using pressure adhesive for fastening to metal and exposed to the outside air is not acceptable.
- E. Dampers shall use the turned-metal principle on long closing ends with no metal-to-metal contact for proper sealing.
- F. The damper shaft shall be mechanically fastened to the blade, and shall operate in bearings made of nylon or other material which does not require lubrication.

#### 2.06 Filter:

- A. Each unit ventilator shall be equipped with a one-piece filter located to provide filtration of the return air/outdoor air mixture, in lieu of separate filters for each air stream. The entire filter surface must be useable for filtration of 100% room air or 100% of outdoor air. The filter shall be easily accessible from the front, and removable in one piece without removal of the unit return air damper stop. The unit shall ship with a factory installed 1" thick fiberglass, single-use type.

B. Spare filters shall be (SELECT):

1. 1" thick fiberglass, single-use type.
2. 1" thick permanent wire mesh washable.
3. 1" thick permanent metal frames with replaceable media.

2.07 Control Components:

A. The hot water or steam heating coil shall use a factory selectable, field installed, modulating control valve to modulate the heating medium during the heating cycle. Upon a power failure, the modulating heating valve shall spring return to the normally open position for flow of water. Modulating valves without spring return to the normal position upon a power failure shall not be acceptable. The modulating valves shall be of the 2-way or 3-way configuration as specified in the valve specifications.

B. The hot water or steam heating coil shall use a factory selectable, field installed, end of cycle control valve to control the heating medium during the heating cycle. Upon a power failure, the heating valve shall spring return to the normally open position for flow of water. Valves without spring return to the normal position upon a power failure shall not be acceptable. The valves shall be of the 2-way or 3-way configuration as specified in the valve specifications.

C. Each unit ventilator shall be furnished capable of accepting direct coupled damper actuators and, if a hot water coil is furnished, with a factory installed low temperature freezestat provided on the leaving edge of the water heating coil in a wave-like configuration to sense multiple locations and shall react to possible freezing conditions. The temperature control contractor shall be responsible for the proper operation of controls to prevent damage of any unit ventilator components while ensuring comfort.

2.08 Control Functions:

A. The Unit Ventilator Digital Controller (here after referred to as UVC) shall support ASHRAE Cycle II operation. The control cycle shall be used to maintain the required minimum amount of ventilation whenever possible, which can be increased during normal operation for economizer cooling, but can also be reduced to prevent excessively cold discharge air temperatures.

B. Cool Mode:

1. A Reheat State shall be provided as a "normal" state that the UVC can go into when Cool mode is active. The Reheat State shall be typically active when reheat is required to maintain VCLL while maintaining the required OA damper position. When Reheat State is active, then the UVC shall use the unit's heating capability as needed to maintain the VCLL setpoint. The UVC shall monitor the wet heat coil leaving air temperature thermostat (if provided) in order to prevent coil freezing conditions. The CO2 Demand Controlled Ventilation function shall be active, if the unit is equipped for CO2 Demand Controlled Ventilation control, and the OAD shall be adjusted as needed to maintain the CO2 setpoint. The UVC shall remain in this state until one of the transition out conditions become true, or until one of the super state transition out conditions becomes true.

2. A Low Limit State shall be provided as a "non-normal" state that the UVC can go into while Cool mode is active. The Low Limit state shall typically follow the Reheat state when the UVC has reached 100% heat and still cannot maintain VCLL. When the Low Limit State becomes active, the Low Limit PI-loop shall override the OAD minimum position and adjust the OAD toward closed as necessary to maintain the DAT setpoint.



2.09 Unit Ventilator Options / Accessories:

A. Ventimatic Shutter (Room Exhaust)

1. Where indicated, the unit manufacturer shall provide a passive (non-powered) "in-room" air pressure relief Ventimatic shutter, mounted on a separate wall louver to prevent excessive static pressure. The Ventimatic shutter shall use gravity for preventing outside air from blowing into the room and shall be made of a temperature resistant glass fabric impregnated with silicone rubber for flexibility. The fabric shall retain its original properties down to -50F.

B. Classroom Matching Accessories

1. Furnish and install in accordance with manufacturer's printed instructions, matching accessories; shelf cabinets, sink and bubbler cabinets, and filler sections, where indicated on the plans. Colors to match the unit ventilator. All accessory section to be with draft-stop system where the unit ventilator is so indicated. Shelving lengths to be scaled from drawings. Top of shelving to be made of Formica. Sinks to be stainless steel. All sections to have adjustable kick plates, and leveling legs and slots for spline attachment to the unit ventilator matching edges.

C. Outdoor Air Intake Louver: Outdoor air intake louver shall be provided by unit ventilator manufacturer except as otherwise noted on the drawings. (SELECT one:)

1. Masonry wall intake louver shall be constructed with horizontal chevron type blades. Provide weep holes in the louver frame and diamond pattern expanded aluminum bird screen on the interior side. Louver shall be fabricated of extruded aluminum 6063-T5. The intake assembly and frame shall be 16 ga. horizontal chevron type aluminum blades in a 12 ga. frame, with (SELECT) [1. unfinished capable of field painting], OR [2. manufacturer's oven baked powder paint finish and color for selection by the Architect], OR [3. clear anodized finish].

2. Panel wall or masonry wall intake louver shall be constructed with vertical blade double brake type blades. Provide weep holes along face of bottom frame and diamond pattern expanded aluminum bird screen on the interior side. Louver shall be fabricated of extruded aluminum 6063-T5. The intake assembly and frame shall be 16 ga. vertical blade double brake type aluminum blades in a 14 ga. frame, with (SELECT) [1. unfinished capable of field painting], OR [2. manufacturer's oven baked powder paint finish and color for selection by the Architect] OR, [3. clear anodized finish].

3. (optional) Where indicated, each intake louver assembly shall be furnished with a matching four sided flange around the perimeter of the opening of same material and finish as louver.

4. (optional) Where indicated, each intake louver assembly shall be furnished with a decorative aluminum intake grille with square holes to match the louver opening, maximizing the air opening. The grille shall come with holes for mounting to building exteriors. The grille shall be of same material and finish as the louver.

D. SD Card: An optional SD card shall be available as a factory installed option, to be used to collect trend data.

2.010 Manufactures:

- A. Daikin.
- B. Airdale,
- C. AAF
- D. Temspec.

PART 3: EXECUTION

### 3.01 INSTALLATION

- A. Install all equipment in strict accordance with manufacturer's instructions and so as to be compatible with the intent of the respective system performance requirement.
- B. The System Integrator/Controls contractor shall be responsible for the integration of all factory provided unit mounted controls and unit communications as required/specified for unit integration into the Building Automation System and proper unit operation.
- C. Contractor shall clean each unit and accessory section of construction dust and debris, prior to turning systems over to the owner.
- D. Contractor shall install clean filters in each unit at time of system commissioning, and shall deliver to the owner one complete set of spare filters, and one spare motor of each type used in the project.
- E. System Integrator/Controls contractor shall be responsible for the integration of all factory provided unit mounted controls and unit communications as required/specified for unit integration into the Building Automation System and proper unit operation.
- F. Installer shall engage the services of manufacturer's factory trained service technician to provide check, test, and start-up of each unit ventilator system.
- G. Contractor shall provide one-year warranty for furnishing parts and labor for replacing any part of the unit ventilator or accessory sections, which becomes defective in operation. Unit ventilator manufacturer's representative shall maintain a local stock of replacement parts to support the systems specified herein.
- H. Contractor shall submit a completed "Check Test and Start Sheet" for each Unit Ventilator installed for verification of proper installation and start up.

## SECTION 237416.11 – PACKAGED ROOFTOP AIR-CONDITIONING UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components:
  - 1. Fans, drives, and motors.
  - 2. Gas furnaces.
  - 3. Controls.
  - 4. Roof curbs.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of RTU.
- B. Shop Drawings: For each packaged, small-capacity, rooftop air-conditioning unit.
  - 1. Include plans, elevations, sections, and mounting 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.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. System startup reports.

#### 1.4 CLOSEOUT SUBMITTALS

#### 1.5 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 1 year(s) from date of Substantial Completion.
  - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- 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. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE 15 Compliance: For refrigeration system safety.
- E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. UL Compliance: Comply with UL 1995.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Daikin Applied.
  - 2. Lennox Industries, Inc.; Lennox International.
  - 3. CARRIER

### 2.3 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.
  - 1. Shafts: With field-adjustable alignment.
    - a. Turned, ground, and polished hot-rolled steel with keyway.
  - 2. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
    - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
  - 3. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
  - 4. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch .

5. Shaft Lubrication Lines: Extended to a location outside the casing.
  6. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.
    - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
- C. Drives, Direct: Factory-mounted, direct drive.
- D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with service factor based on fan motor.
1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
  2. Belts: Oil resistant, non-sparking and nonstatic; in matched sets for multiple-belt drives.
  3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch-thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.
- E. Relief-Air Fan: , shaft mounted on permanently lubricated motor.
- F. Motors:
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  2. 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.
  3. Enclosure Type: Totally enclosed, fan cooled .
  4. Efficiency: Premium efficient as defined in NEMA MG 1.
  5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
- 2.4 GAS FURNACES
- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Burners: Stainless steel.
1. Fuel: Natural gas.
  2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
  3. Gas Control Valve: Modulating.
  4. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
- D. Heat-Exchanger and Drain Pan: Stainless steel.

- E. Venting, Gravity: Gravity vented with vertical extension.
- F. Safety Controls:
  - 1. Gas Manifold: Safety switches and controls complying with ANSI standards .

## 2.5 CONTROLS

### A. Basic Unit Controls:

- 1. Control-voltage transformer.
- 2. Wall-mounted thermostat or sensor with the following features:
  - a. Heat-cool-off switch.
  - b. Fan on-auto switch.
  - c. Fan-speed switch.
  - d. Automatic changeover.
  - e. Adjustable deadband.
  - f. Exposed set point.
  - g. Exposed indication.
  - h. Degree F indication.
  - i. Unoccupied-period-override push button.
  - j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.
- 3. Wall-mounted humidistat or sensor with the following features:
  - a. Concealed set point.
  - b. Exposed indication.
- 4. Remote Wall -Mounted Annunciator Panel for Each Unit:
  - a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
  - b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
  - c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

### B. DDC Controller:

- 1. Controller shall have volatile-memory backup.
- 2. Safety Control Operation:
  - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire-alarm control panel.
  - b. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
- 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of four programmable periods per day.
- 4. Unoccupied Period:
  - a. Heating Setback: 10 deg F .
  - b. Cooling Setback: System off.
  - c. Override Operation: Two hours.

5. Supply Fan Operation:
    - a. Occupied Periods: Run fan continuously.
    - b. Unoccupied Periods: Cycle fan to maintain setback temperature.
  6. Gas Furnace Operation:
    - a. Occupied Periods: Modulate burner to maintain room temperature.
    - b. Unoccupied Periods: Cycle burner to maintain setback temperature.
- C. Interface Requirements for HVAC Instrumentation and Control System:
1. Interface relay for scheduled operation.
  2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
  3. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:
    - a. Adjusting set points.
    - b. Monitoring supply fan start, stop, and operation.
    - c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
    - d. Monitoring occupied and unoccupied operations.
    - e. Monitoring constant and variable motor loads.
    - f. Monitoring variable-frequency drive operation.
    - g. Monitoring cooling load.
    - h. Monitoring economizer cycles.
    - i. Monitoring air-distribution static pressure and ventilation air volume.

## 2.6 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    - a. Materials: ASTM C1071, Type I or II.
    - b. Thickness: 2 inches .
  2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
    - a. Liner Adhesive: Comply with ASTM C916, Type I.
    - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    - c. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
    - d. Liner Adhesive: Comply with ASTM C916, Type I.
- B. Curb Dimensions: Height of 14 inches .

## 2.7 MATERIALS

### A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

### B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

### C. Galvanized Steel: ASTM A653/A653M.

### D. Aluminum: ASTM B209.

## 2.8 SOURCE QUALITY CONTROL

### A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

### B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.
- C. Unit Support: Install unit level on structural . Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.



### 3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to RTU, allow space for service and maintenance.
- C. Connect piping to unit mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4 , ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- F. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- G. Steam and Condensate Piping: Comply with applicable requirements in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Heating Piping Specialties." Install shutoff valve at steam supply connections, float and thermostatic trap, and union or flange at each coil return connection. Install gate valve and inlet strainer at supply connection of dry steam humidifiers, and inverted bucket steam trap to condensate return connection.
- H. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

### 3.3 DUCT CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
  - 4. Install return-air duct continuously through roof structure.

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect electrical 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.
- D. 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 as layers of black with engraved white letters at least 1/2 inch high.
  - 3. Locate nameplate where easily visible.

### 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."

END OF SECTION 237416.11

## SECTION 238113 – AIR COOLED CHILLER

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.

#### 1.02 REFERENCES

- A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.
- B. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

#### 1.03 SUBMITTALS

- A. Submit shop drawings and product data in accordance with the specifications.
- B. Submittals shall include the following:
1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
  2. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
  3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
  4. Schematic diagram of control system indicating points for field interface/connection.
  5. Diagram shall fully delineate field and factory wiring.
  6. Installation and operating manuals.

#### 1.04 QUALITY ASSURANCE

- A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.
- B. Regulatory Requirements: Comply with the codes and standards specified.
- C. Chiller manufacturer plant must be ISO Registered.

#### 1.05 DELIVERY AND HANDLING

- A. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
- B. Comply with the manufacturer's instructions for rigging and handling equipment.

#### 1.06 WARRANTY

- A. Standard Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.

- B. 1st Year Parts and Labor Warranty: Entire unit for 1 year
- C. Extended Compressor Warranty: Four (4) years extended compressor warranty, parts only.
- D. Extended Unit Warranty: None.
- E. Refrigerant Warranty: One (1) year R410A refrigerant.
- F. Delay Warranty Start: None.

#### 1.07 MAINTENANCE

- A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

### PART 2: PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS

- A. Daikin Applied
- B. Carrier
- C. Multistack

#### 2.02 UNIT DESCRIPTION

- A. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
- B. Chiller shall be functionally tested at the factory to ensure trouble free field operation

#### 2.03 DESIGN REQUIREMENTS

- A. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
- B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.
- C. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
- D. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
- E. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment ( parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

Sound Pressure (at 30 feet)											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA

2.04 CHILLER COMPONENTS

A. Compressor

1. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

B. Evaporator

1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).
2. The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4" (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
3. The water-side maximum design pressure shall be rated at a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

C. Condenser

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
2. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit

1. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

E. Construction

1. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.
2. Upper and lower section of unit shall have protective and decorative louvers covering the coils and unit end and have painted steel wraps enclosing the coil end sections and piping.

F. Control System

1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
2. Shall include optional single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

G. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.
3. Shutdown Alarms
  - a. No evaporator water flow (auto-restart)
  - b. Sensor failures
  - c. Low evaporator pressure
  - d. Evaporator freeze protection
  - e. High condenser pressure
  - f. Outside ambient temperature (auto-restart)
  - g. Motor protection system
  - h. Phase voltage protection (Optional)
4. Limit Alarms
  - a. Condenser pressure stage down, unloads unit at high discharge pressures.
  - b. Low ambient lockout, shuts off unit at low ambient temperatures.
  - c. Low evaporator pressure hold, holds stage #1 until pressure rises.
  - d. Low evaporator pressure unload, shuts off one compressor.
5. Unit Enable Section

- a. Enables unit operation from either local keypad, digital input, or BAS
- 6. Unit Mode Selection
  - a. Selects standard cooling, ice, glycol, or test operation mode
- 7. Analog Inputs:
  - a. Reset of leaving water temperature, 4-20 mA\
  - b. Current Limit
- 8. Digital Inputs
  - a. Unit off switch
  - b. Remote start/stop
  - c. Flow switch
  - d. Ice mode switch, converts operation and setpoints for ice production
  - e. Motor protection
- 9. Digital Outputs
  - a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
  - b. Evaporator pump; field wired, starts pump when unit is set to start
- 10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.
- 11. Building Automation System (BAS) Interface
  - a. Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK ® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
  - b. BACnet MS/TP master (Clause 9)
  - c. BACnet IP, (Annex J)
  - d. BACnet ISO 8802-3, (Ethernet)
  - e. LONMARK FTT-10A. The unit controller shall be LONMARK® certified.
  - f. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
  - g. For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.
  - h. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

## 2.05 OPTIONS AND ACCESSORIES

- A. The following options are to be included:
  - 1. Hot Gas Bypass: allows unit operation to 10 percent of full load. Includes factory-mounted hot gas bypass valve, solenoid valve, and manual shutoff valve for each circuit.
  - 2. Rapid Restore™: The chiller shall be equipped with the capability to restart and to reach full load more quickly than standard in case of a power interruption. The chiller shall be capable of rapidly restarting after power loss duration of up to 180 seconds. The time to restart the chiller shall be a maximum of 125 seconds, and full load shall be achieved in 220 seconds from power restoration.

Fast Loading Stand-By Chiller: The chiller shall be equipped with the capability to start and to reach full load more quickly than standard in the event that the primary chiller system is disabled. The chiller shall be capable of rapidly achieving full capacity. The time to full load shall be achieved in 115 seconds.

3. Low Ambient Control: Fan VFD allows unit operation from 32°F down to -10°F (-23.3 C).
4. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line-to-ground fault currents less than those required for conductor protection.
5. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
6. BAS interface module to provide interface with the BACnet MSTP protocol.
7. The following accessories, if selected, are to be included:
  - a. Spring vibration isolators for field installation
  - b. Rubber-in-shear vibration isolators for field installation
  - c. Factory-mounted thermal dispersion type flow switch
  - d. Field-mounted, paddle type, chilled water flow switch field wired to the control panel
  - e. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted or field installed)
  - f. 115V GFI convenience outlet

B. Optional Factory-Installed Pump Package: None

1. These pump package accessories, if selected, will also be included:
  - a. Water pressure gauges on the pump suction and discharge
  - b. Expansion tank with size increments from 4.4 to 90 gallons, field installed (small sizes can be factory mounted
  - c. Air separator with air vent, field installed
  - d. Storage tanks, vertical, insulated, 150, 300, 600, 1000 gallon sizes with optional immersion heater, field installed.

### PART 3: EXECUTION

#### 3.01 INSTALLATION

- A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.
- B. Adjust and level chiller in alignment on supports.
- C. Coordinate electrical installation with electrical contractor.
- D. Coordinate controls with control contractor.
- E. Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.

#### 3.02 START-UP

- A. Provide testing and starting of machine, and instruct the Owner in its proper operation and maintenance.



## SECTION 238129 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

### PART 1 - PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

#### 1.2 Variable Refrigerant Volume (VRV) Equipment Specifications.

#### 1.3 SCOPE

##### A. The work covered under this section shall include the following:

1. Complete variable refrigerant flow system including equipment, piping, and controls.
2. System shall be a VRF (variable refrigerant flow) multi split air conditioning system. The system will utilize an air-cooled condensing unit supplying multiple indoor units.
3. The VRF (Variable Refrigerant Flow) system shall be a simultaneous cooling and heating heat pump system. The VRF system shall consist of an outdoor unit, high efficiency heat recovery units designed for minimum piping and maximum design flexibility, indoor units, and controls by the equipment manufacturer. Each indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of other indoor units.
4. The variable refrigerant flow system piping system shall be designed by a manufacturer's certified designer. If Basis-of-Design system is not used, contractor shall submit fully revised piping layout to engineer, complete with revised locations and quantities of heat recovery units. Revised piping layout shall be submitted with equipment submittal for review and approval by engineer. Revised piping layout shall not affect performance of indoor or outdoor units. The contractor is responsible for all costs associated with additional review required by engineer.
5. The variable refrigerant flow system piping system shall be installed by a manufacturer's certified contractor.
6. The installing contractor shall be trained and certified at the manufacturer's training facility prior to installation, start-up, and commissioning. Submit for review the installation contractor's certification from the manufacturer. This certification shall include the company certification as well as individual certifications for each contractor which will be working on this project.
7. VRF manufacturer shall provide a data translator from VRF controls to existing Alerton campus controller to view, modify, and adjust all settings from Alerton system.
8. VRF manufacturer to provide service technician to coordinate and install all necessary equipment needed with associated wiring to communicate with Existing Alerton system.
9. The refrigeration piping system shall be provided, installed, tested, evacuated, and charged.

##### B. QUALITY ASSURANCE

1. Manufacturers Field Service - Engage a factory-authorized service representative to inspect field assembled components and equipment installation, including connections, and to assist in field testing.
2. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be manufactured in a facility registered to ISO 9001 and ISO14001.
3. The refrigeration piping system shall be provided, installed, tested, evacuated and charged in accordance with the manufacturer's recommendations, ANSI, ASHRAE, and ARI's Safety Code for Mechanical Refrigeration, state and local codes.

C. 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. 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.

#### 1.4 SUBMITTALS

- A. Provide shop drawings on this equipment as described in section 15010, 1.04.

#### 1.5 PART 2 - PRODUCTS

##### A. MANUFACTURERS

1. Manufacturers - Provide products by one of the following:
2. Daikin Industries (Basis of Design)
3. Samsung
4. Mitsubishi
5. Alternate Bid will be Daikin – If Daikin chosen as base bid, Alternate cost will be of \$0.00

##### B. REFRIGERANT COMPONENTS

1. The equipment specified in this section shall operate with refrigerant R410A – no exceptions or substitutions.

C. The system shall utilize fully modulating electronic expansion valves.

##### D. Refrigerant Piping

1. The refrigerant piping system shall be provided complete and installed in accordance with the manufacturer's recommendations and as specified herein. The size of the refrigerant pipes shall be obtained from the equipment manufacturer unless otherwise shown on the drawings.

2. Pipe, Fittings, and Accessories – The pipe shall be type ACR ‘L’ hard drawn copper refrigerant tubing with hard wrought copper fittings. All of the joints shall be brazed with a filler material that complies with AWS classification BcuP-5. A sight glass with moisture indicator shall be provided if not provided with equipment. Use type ‘L’ copper tubing to pipe the relief valve discharge to the outside.
3. Condensate Drain Piping - Shall be type 'L' copper tubing.
4. Pipe Hangers and Supports - Shall be as required in section 15050.
5. All refrigerant lines shall be insulated from the outdoor unit to the indoor terminal 1.units as shown in section 15250.
6. The system shall be capable of operating with refrigerant piping up to 492 equivalent feet, a total combined length of 984 feet of piping between the condensing and fan coil units with 164 feet maximum vertical difference, without any oil traps or additional equipment. The vertical difference shall not exceed a maximum of 131 feet where the outdoor unit is located below the indoor unit.

#### 1.6 HEAT RECOVERY UNITS FOR SIMULTANEOUS HEATING AND COOLING SYSTEMS

- A. General - The Heat Recovery Unit shall be designed for use with VRF equipment of the same manufacturer. These units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The heat recovery unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.
- B. Unit Cabinet
  1. The casing shall be fabricated of galvanized steel.
  2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
  3. The unit shall house tube-in-tube heat exchangers.
  4. Refrigerant - R410A refrigerant shall be required for Heat Recovery units in conjunction with outdoor unit systems.
- C. Refrigerant Valves
  1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and/or three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
  2. Each branch shall have multiple two-position valves to control refrigerant flow for optimum efficiency.
  3. Service shut-off valves shall be installed for each branch to allow service to any indoor unit without field interruption to overall system operation. Shut-off valves shall be full-port ball valves, rated at 700 PSIG, with a Schrader port.
  4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.
- D. Electrical
  1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
  2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).
  3. The Heat Recovery unit shall be controlled by integral microprocessors.

4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

## 1.7 INDOOR AIR HANDLING UNITS

- A. It shall be possible for the total connected capacity of the indoor units to be between 50 and 130% of the capacity of the outdoor unit.
  1. Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by an electronic proportional expansion valve. This valve will be controlled by two pipe thermistors, a return air and discharge air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.
  2. Each indoor unit shall have an operating voltage of 208-230V/1 phase/60Hz. The indoor unit shall supply demand capacity information to the outdoor unit via its control algorithm.
- B. Four (4) Way Ceiling Cassette Indoor Unit
  1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a four-way air distribution type, impact resistant and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
  2. Construction
    - a. Return air shall be through the concentric panel, which shall include a filter.
    - b. The indoor unit shall be equipped with a condensate pan.
    - c. The indoor unit shall be equipped with a return air thermistor.
    - d. The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.
    - e. The voltage range shall be 253 volts maximum and 187 volts minimum.
    - f. The indoor unit shall be equipped with a condensate pump capable of providing at least 19" of lift.
  3. Unit Cabinet
    - a. The cabinet shall be space saving and shall be located into the ceiling.
- C. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
- D. Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
  1. Fan
- E. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
- F. The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.

- G. The airflow rate shall be adjustable and have high, medium and low fan settings.
  - 1. The fan motor shall be thermally protected.
- H. Coil
  - 1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
  - 2. A condensate pan shall be located under the coil. The condensate pan shall have a built in high level safety alarm to shut down the unit.
  - 3. A thermistor shall be located on the liquid and gas line.
- I. One (1) Way Ceiling Cassette Indoor Unit
  - 1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a one-way air distribution type, impact resistant and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
  - 2. Construction
    - a. The indoor unit shall be completely factory assembled and tested.
  - 3. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
  - 4. Return air shall be through the concentric panel, which shall include a filter.
  - 5. The indoor units shall be equipped with a condensate pan.
  - 6. The indoor units shall be equipped with a return air thermistor.
  - 7. The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.
  - 8. The voltage range shall be 253 volts maximum and 187 volts minimum.
  - 9. The indoor unit shall be equipped with a condensate pump capable of providing at least 23" of lift.
  - 10. Unit Cabinet
  - 11. The cabinet shall be space saving and shall be located into the ceiling.
    - a. Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
  - 12. Fan
- J. The fan shall be direct-drive fan type with statically and dynamically balanced impeller with high and low fan speeds available.
- K. The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
- L. The airflow rate shall be adjustable and have high, medium and low fan settings.
  - 1. The fan motor shall be thermally protected.
  - 2. Filter - The return air shall be filtered by means of a long-life filter.
  - 3. Coil

- M. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
  - 1. A condensate pan shall be located under the coil. The coil in the condensate pan shall have a built in high level safety alarm to shut down the unit.
  - 2. A thermistor shall be located on the liquid and gas line.

## 1.8 CONTROLS

- A. The units shall have controls provided with the unit by the manufacturer to perform input functions necessary to operate the system.
  - 1. Computerized PID control shall be used to maintain room temperature within 1F of setpoint.

## 1.9 CONTROLLERS

- A. Physical Characteristics - The control system shall be a neutral color plastic material with a Liquid Crystal Display (LCD).
- B. Electrical Characteristics
  - 1. General - From each circuit board to the controls, the electrical voltage shall be 16 - 24 volts DC.
  - 2. Wiring: Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.
  - 3. Wiring Size: The wire shall be a shielded, size AWG16-2 or AWG 18-2.
- C. Individual Zone Controller - Wired Remote Controller
  - 1. The wired remote controller shall be able to control 1 group (maximum of 16 fan coil units) and shall be able to function as follows:
- D. The controller shall have a self-diagnosis function that constantly monitors the system for malfunctions (total of 80 components).
- E. The controller shall be able to immediately display fault location and condition.
  - 1. An LCD digital display shall allow the temperature to be set in 1F units.
- F. The controller shall be equipped with a thermostat sensor in the remote controller making possible more comfortable room temperature control.
  - 1. The wired remote controller shall have the following features:
- G. Operation - Start/Stop, Operation Mode, Temperature Setting, 60F - 90F setpoint Range, Fan Speed, Airflow Direction.

1. Monitoring - Status, malfunction flashing, malfunction content, filter sign, operation mode, temperature setting, permit/prohibit selection, fan speed, airflow direction.
    - a. Scheduling - ON/OFF Timer
  2. Control Management - Field Setting Mode, Group Setting, Auto Restart
- H. Individual Zone Controller B Simplified Wired Remote Controller
1. The simplified wired remote controller shall be able to control 1 group (maximum of 16 fan coil units).
  2. The simplified wired remote controller shall have the following features:
- I. Operation - Start/Stop, Operation Mode, Temperature Setting, 60F - 90F Set Point Range, Fan Speed, Airflow Direction.
1. Monitoring - Status, malfunction flashing, malfunction content, filter sign, operation mode, temperature setting, permit/prohibit selection, fan speed, airflow direction.
    - a. Scheduling - ON/OFF Timer.
  2. Control Management - Field Setting Mode, Group Setting, Auto Restart.
  3. System Remote Controller - The controller shall control up to 50 units in 4 zones and shall be able to be used in conjunction with all room controller types. Collective and individual group commands are available with permit/prohibit individual remote controller function. The system controller shall use the following connections for power and remote monitoring:
  4. L1: Power supply (60 Hz, 208-230 VAC) C1: Inter-unit control wiring (Low voltage) C3: Auxiliary
  5. C4: Ground for inter-unit control wiring
  6. A1: Input for turning ON air conditioners concurrently A2: Input for turning OFF air conditioners concurrently A3: Common input for turning air conditioners ON or OFF B1: On operation state indicator output
  7. B2: Alarm indicator output B3: Common indicator output
  8. Web Enabled Intelligent Controller
  9. This controller shall be wall mounted and hard wired. It will be manufactured with an LCD display and will be the manufacturers standard color. The controller will be capable of individually controlling the following functions on at least 50 indoor fan coil units:
    10. On/off.
    11. Operating mode.
    12. Set point.
    13. Fan speed.
    14. Louver position.
    15. Timer settings.
    16. Test run.
  17. The controller shall also be capable of displaying the following information individually for at least 50 indoor fan coil units:
    18. On/off.
    19. Operating mode.
    20. Set point.
    21. Fan speed.
    22. Louver position.
    23. Timer settings.
    24. Test run.
    25. Fault diagnosis.

26. Each Intelligent controller unit shall be accessed both locally and remotely via standard Internet Explorer IE6 or IE7 software. The Intelligent controller will be able to indicate system alarms via volt free contacts as well as providing control points for other DO devices. Additionally, the intelligent controller shall be able to monitor individual usage of heating and cooling demands, report alarm and conditions to nominated email address, and enable remote alteration of systems setpoints and schedules.

J. PART 3 - EXECUTION

1.10 INSTALLATION

- A. Install all piping, fittings, and insulation to meet manufacturers requirements. Install units level and plumb. Evaporator-fan components shall be installed using manufacturers standard mounting devices securely fastened to building structure. Install and connect refrigerant tubing and fittings.

1. Installer shall supply isolation ball valves for zoned refrigerant isolation. Installer shall supply Isolation ball valves with Schrader connection for isolating refrigerant charge and evacuation at each connected air handling unit and condensing unit. Isolation ball valves, with Schrader connection, are required for instances of air handling unit isolation for troubleshooting, repair, or replacement without affecting the remainder of the system. Isolation ball valves with Schrader connection are also required at condensing unit connection to isolate unit for troubleshooting, repair or replacement and as required to provide partial capacity Heating/Cooling in the instance of a failure of one of the multiple outdoor unit (condensing unit) compressors.
2. During brazing an inert gas (such as nitrogen) shall be continuously passed through the system at a rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale. After piping has been completed, the refrigerant piping system shall be pressure tested at a pressure of 300 psi on the high side and 150 psi on the low side. The pressure shall be maintained on the system for a minimum of 12 hours. The system shall be evacuated when the surrounding ambient air is not less than 60 F. If the temperature is less, auxiliary heat must be provided to insure proper evacuating conditions. A minimum vacuum of 500 Microns of Hg. shall be pulled on the system and maintained for 12 hours. The vacuum pump displacement shall be not less than 2 cfm for up to 15 tons. The system shall be charged as recommended by the equipment manufacturer.
3. Electrical wiring required by this section, both high and low voltage, shall comply with the Division 16 requirements.
4. Start Up - Engage manufacturer or factory-authorized service representative to perform startup service. Manufacturer shall provide on-site startup and commissioning assistance through job completion. Complete installation and startup. checks according to manufacturer's written instructions. This shall include a factory startup for factory provided control devices as well as configuring control points for other DO devices. Service representative shall completely configure all control devices and establish remote internet connectivity with the owner's energy management department web server.
5. Demonstration - Engage manufacturer or factory-authorized service representative to train Owners maintenance personnel to adjust, operate and maintain individual units and complete system. This shall include training of the owner's energy management department representatives as to establish control system programming, scheduling



- routines, alarm reporting, system topography, communication protocols and password level assignments.
6. The indoor air handling and outside condensing units shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings. The first unit installed will be considered the typical mock up and shall require notification, inspection and approval by the designated owner representative and/or architect and engineer before any additional installations will be allowed.
  7. Provide a typed list of all the different units, their filter sizes, and belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size, belt size, and the number of filters and belts required for each unit. In addition to this, submit to the Owner two additional copies of the list, distributed to:
    8. Project Manager, Office of Design and Construction Services, Gatehouse Administrative Center, 8115 Gatehouse Road, Suite 3500, Falls Church, VA 22042.
    9. Coordinator, Mechanical Maintenance Division, Maintenance Services, 5025 Sideburn Road, Fairfax, Virginia 22032.
  10. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each condensing unit. Tag is to be screwed or riveted to unit.

END OF SECTION 238129

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Copper building wire.
  - 2. Metal-clad cable, Type MC.
  - 3. Fire-alarm wire and cable.
  - 4. Connectors and splices.

#### 1.3 DEFINITIONS

- A. PV: Photovoltaic.
- B. RoHS: Restriction of Hazardous Substances.
- C. VFC: Variable-frequency controller.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For .

#### 1.6 QUALITY ASSURANCE

### PART 2 - PRODUCTS

#### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
  2. Belden Inc.
  3. Cerro Wire LLC.
  4. Okonite Company (The).
  5. Service Wire Co.
  6. Southwire Company.
  7. WESCO.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.
- F. Shield:
1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire , and sunlight- and oil-resistant outer PVC jacket.

## 2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
  2. Atkore International (AFC Cable Systems).
  3. Belden Inc.
  4. Okonite Company (The).
  5. Southwire Company.
  6. WESCO.
- C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit .
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors .

F. Ground Conductor: Insulated .

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

H. Armor: Steel , interlocked.

I. Jacket: PVC applied over armor.

## 2.3 FIRE-ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Genesis Cable Products; Honeywell International, Inc.
4. Superior Essex Inc.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, not less than No. 16 AWG .

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

## 2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Atkore International (AFC Cable Systems).
  - 2. Hubbell Incorporated (Hubbell Power Systems).
  - 3. TE Connectivity Ltd.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper .
  - 2. Type: Two hole with standard barrels.
  - 3. Termination: Compression .

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
  - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
  - 1. Copper. Solid for No. 14 AWG and smaller; stranded for No. 12 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 14 AWG and smaller.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway .
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway .
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway .

- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway .
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway .
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

### 3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### 3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."
  - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
  - 2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system.
    - a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.
  - 3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is permitted.
  - 4. Signaling Line Circuits: Power-limited fire-alarm cables shall not be installed in the same cable or pathway as signaling line circuits.

- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
- E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.
- F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

### 3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
- D. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems" for connecting, terminating, and identifying wires and cables.

### 3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

### 3.9 FIELD QUALITY CONTROL

- A. Administrant for Tests and Inspections:

- 1. Administer and perform tests and inspections.

- B. Tests and Inspections:

- 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each of the following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    - b. Test bolted connections for high resistance using one of the following:
      - 1) A low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
  - 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  - 4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

- C. Cables will be considered defective if they do not pass tests and inspections.

- D. Prepare test and inspection reports to record the following:

- 1. Procedures used.
  - 2. Results that comply with requirements.



3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Foundation steel electrodes.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Ground rods.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
      - 1) Ground rods.
      - 2) Ground rings.
      - 3) Grounding arrangements and connections for separately derived systems.
    - b. Instructions for periodic testing and inspection of grounding features at ground rings grounding connections for separately derived systems based on NFPA 70B .
      - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.

- 2) Include recommended testing intervals.

## 1.6 QUALITY ASSURANCE

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ABB (Electrification Products Division).
  2. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
  3. Hubbell Incorporated (Burndy).
  4. ILSCO.
  5. Siemens Industry, Inc., Energy Management Division.

### 2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 x 12 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, copper lugs. Rated for 600 A.
- M. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- N. Water Pipe Clamps:
  - 1. Mechanical type, two pieces with zinc-plated bolts.
    - a. Material: Tin-plated aluminum .
    - b. Listed for direct burial.
  - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## 2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel ; 3/4 inch by 10 feet .

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

### 3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Utility Co. Transformers: Coordinate requirements with utility co.

### 3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch 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. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. Use exothermic welds for all below-grade connections.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 feet long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.

- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal , and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526



## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Steel slotted support systems.
- 2. Conduit and cable support devices.
- 3. Support for conductors in vertical conduit.
- 4. Structural steel for fabricated supports and restraints.
- 5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
- 6. Fabricated metal equipment support assemblies.

- B. Related Requirements:

- 1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - a. Slotted support systems, hardware, and accessories.
  - b. Clamps.
  - c. Hangers.
  - d. Sockets.
  - e. Eye nuts.
  - f. Fasteners.
  - g. Anchors.
  - h. Saddles.
  - i. Brackets.
- 2. Include rated capacities and furnished specialties and accessories.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, 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. Welding certificates.

#### 1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M .

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
2. Component Importance Factor: 1.0.

## 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABB (Electrification Products Division).
    - b. Atkore International (Allied Tube & Conduit).
    - c. Atkore International (Unistrut).
    - d. Eaton (B-line).
    - e. G-Strut.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel .
  4. Channel Width: Selected for applicable load criteria .
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Eaton (B-line).

- 2) Hilti, Inc.
- 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
- 4) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 .
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  1. NECA 1.
  2. NECA 101
  3. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps .

- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC and RMC may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. 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 Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 .
  - 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 comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use [3000 psi] <Insert value>, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils .

END OF SECTION 260529

## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Boxes, enclosures, and cabinets.
  - 5. Handholes and boxes for exterior underground cabling.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal 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.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

#### A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB (Electrification Products Division).
  - b. Atkore International (Allied Tube & Conduit).
  - c. Wheatland Tube Company.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated .
  - a. Comply with NEMA RN 1.
  - b. Coating Thickness: 0.040 inch, minimum.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel or aluminum.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

#### B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB (Electrification Products Division).
  - b. Atkore International (Allied Tube & Conduit).
  - c. Wheatland Tube Company.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:
  - a. Material: Steel or die cast.
  - b. Type: Setscrew or compression.
7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.



- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

### A. Nonmetallic Conduit:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB (Electrification Products Division).
  - b. Atkore International (AFC Cable Systems).
  - c. Hubbell Incorporated (Raco Taymac Bell).
- 2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 3. RNC: Type EPC-40-PVC , complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- 4. LFNC: Comply with UL 1660.

### B. Nonmetallic Fittings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ABB (Electrification Products Division).
  - b. Atkore International (AFC Cable Systems).
  - c. Hubbell Incorporated (Raco Taymac Bell).
- 2. Fittings, General: Listed and labeled for type of conduit, location, and use.
- 3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  - a. Fittings for LFNC: Comply with UL 514B.
- 4. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. ABB (Electrification Products Division).
- 2. Eaton (B-line).
- 3. Hubbell Incorporated (Wiegmann).

### B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

- 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

#### 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB (Electrification Products Division).
  - 2. Eaton (Crouse-Hinds).
  - 3. Emerson Electric Co. (Automation Solutions - Appleton - EGS).
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

#### 2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Hubbell Incorporated (Quazite).
    - c. Oldcastle Enclosure Solutions.
  - 2. Standard: Comply with SCTE 77.
  - 3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
  - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
  - 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 6. Cover Legend: Molded lettering, "ELECTRIC" or "COMMUNICATIONS" as noted. .

7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  1. Tests of materials shall be performed by an independent testing agency.
  2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed Conduit: GRC .
  2. Concealed Conduit, Aboveground: GRC EMT RNC, Type EPC-40-PVC.
  3. Underground Conduit: RNC, Type EPC-40-PVC , .
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC .
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R .
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  1. Exposed, Not Subject to Physical Damage: EMT .
  2. Exposed and Subject to Severe Physical Damage: GRC . Raceway locations include the following:
    - a. Mechanical rooms.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT .
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: GRC .
  6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  3. EMT: Use setscrew or compression , cast-metal fittings. Comply with NEMA FB 2.10.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F .

### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. 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.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- X. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- FF. Set metal floor boxes level and flush with finished floor surface.
- GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533



## SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Round sleeves.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 ROUND SLEEVES

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
    - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  2. Seal space outside of sleeves with approved joint compound for wall assemblies.

END OF SECTION 260544

## 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. Section Includes:
  - 1. Labels.
  - 2. Bands and tubes.
  - 3. Tapes and stencils.
  - 4. Tags.
  - 5. Signs.
  - 6. Cable ties.
  - 7. Miscellaneous identification products.

#### 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 electrical identification products.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:

- 1. Black letters on an orange field .
  - 2. Legend: Indicate voltage and system or service type.

- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

- 1. Color shall be factory applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 240-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
  - 4. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 5. Color for Neutral: White or gray.
  - 6. Color for Equipment Grounds: Green .
  - 7. Colors for Isolated Grounds: Green with two or more yellow stripes.

- C. Raceways and Cables Carrying Circuits at More Than 600 V:

- 1. Black letters on an orange field.
  - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

- D. Warning Label Colors:

- 1. Identify system voltage with black letters on an orange background.

- E. Warning labels and signs shall include, but are not limited to, the following legends:

- 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

- F. Equipment Identification Labels:

- 1. Black letters on a white field.

## 2.3 LABELS

- A. Self-Adhesive Wraparound Labels: Write-on, 3-mil- thick, flexible label with acrylic pressure-sensitive adhesive.
  - 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. Brady Corporation.
    - b. Marking Services, Inc.
    - c. Panduit Corp.
  - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 3. Marker for Labels:
    - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.4 BANDS AND TUBES

- A. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.
  - 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. Brady Corporation.
    - b. Panduit Corp.

## 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
  - 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. HellermannTyton.
    - b. Ideal Industries, Inc.
- B. Underground-Line Warning Tape:
  - 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. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. Ideal Industries, Inc.
    - d. LEM Products Inc.

- e. Marking Services, Inc.
2. Tape:
  - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Color and Printing:
  - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
  - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE" .
  - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE" .

## 2.6 TAGS

- A. Write-on Tags:
  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. Brimar Industries, Inc.
    - b. Carlton Industries, LP.
    - c. LEM Products Inc.
    - d. Seton Identification Products; a Brady Corporation company.
  2. Polyester Tags: 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment.
  3. Marker for Tags:
    - a. Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.7 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
  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. Brady Corporation.
    - b. emedco.
    - c. Marking Services, Inc.
  2. Engraved legend.
  3. Thickness:
    - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    - b. For signs larger than 20 sq. in., 1/8 inch thick.
    - c. Engraved legend with black letters on white face .
    - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting .

- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.8 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. HellermannTyton.
  - 2. Ideal Industries, Inc.
  - 3. Marking Services, Inc.
  - 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.

## 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.

- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer .
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
- M. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- N. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- O. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- P. Write-on Tags:
  - 1. Place in a location with high visibility and accessibility.
  - 2. Secure using general-purpose cable ties.
- Q. Laminated Acrylic or Melamine Plastic Signs:



1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.

R. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

### 3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels .
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.
  1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- F. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- G. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.
- H. Equipment Identification Labels:
  1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
  2. Outdoor Equipment: Laminated acrylic or melamine sign .
  3. Equipment to Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
- b. Switchboards.
- c. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- d. Enclosed switches.
- e. Enclosed circuit breakers.
- f. Power-transfer equipment.

END OF SECTION 260553

## 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. Section Includes:

- 1. Indoor occupancy and vacancy sensors.
- 2. Emergency shunt relay.
- 3. Conductors and cables.

- B. Related Requirements:

- 1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings:

- 1. Show installation details for the following:
  - a. Occupancy sensors.
  - b. Vacancy sensors.
- 2. Interconnection diagrams showing field-installed wiring.
- 3. Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

- B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media . Provide names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
  2. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
  2. Douglas Lighting Controls.
  3. Hubbell Incorporated (Hubbell Control Solutions).
  4. Leviton Manufacturing Co., Inc.
  5. Lithonia Lighting; Acuity Brands Lighting, Inc.
  6. Sensor Switch, Inc.
- B. General Requirements for Sensors:
1. Ceiling-mounted, solid-state indoor occupancy sensors.
  2. Dual technology.
  3. Separate power pack.
  4. Hardwired connection to switch .
  5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  6. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  7. Sensor Output: Sensor is powered from the power pack .
  8. Power: Line voltage .
  9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  10. Mounting:

- a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  12. Bypass Switch: Override the "on" function in case of sensor failure.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

## 2.2 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Legrand North America, LLC (WattStopper).
  2. Lighting Control and Design.
- B. Description: NC, electrically held relay, arranged for wiring in parallel with manual switching contacts; complying with UL 924.
1. Coil Rating: 277 V.

## 2.3 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION OF SENSORS

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

#### 3.3 INSTALLATION OF CONTACTORS

- A. Comply with NECA 1.

#### 3.4 INSTALLATION OF WIRING

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.
- D. Size conductors in accordance with 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.

#### 3.5 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify controlled circuits in lighting contactors.
  2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
  3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

### 3.7 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.16 "Addressable-Luminaire Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

## 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. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

- B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of NRTL listing for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.



10. Include schematic and wiring diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer testing agency.
- B. Seismic Qualification Data: Certificates, for switchboards, overcurrent protective devices, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field Quality-Control Reports:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For switchboards and components 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. Routine maintenance requirements for switchboards and all installed components.
    - b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
    - c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

#### 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. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
  2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  3. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
  - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
  2. 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."

### 2.2 SWITCHBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Eaton.
  2. Schneider Electric USA (Square D).
  3. Siemens Industry, Inc., Energy Management Division.
  4. G.E. (General Electric)
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. 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.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.
- H. Front- and Rear-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
  2. Branch Devices: Fixed and individually compartmented mounted.
  3. Sections rear aligned.
- I. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
    - 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."
- J. Indoor Enclosures: Steel, NEMA 250, Type 1 .
- K. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- L. Barriers: Between adjacent switchboard sections.
- M. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.
- N. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- P. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.
- Q. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- R. Buses and Connections: Three phase, four wire unless otherwise indicated.
1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
  2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
  3. Copper feeder circuit-breaker line connections.
  4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
  5. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.

6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
  7. Disconnect Links:
    - a. Isolate neutral bus from incoming neutral conductors.
    - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
  8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- S. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

### 2.3 SURGE PROTECTION DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. Schneider Electric USA (Square D).
  3. Siemens Industry, Inc., Energy Management Division.
- B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.
- C. Features and Accessories:
1. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
  2. Indicator light display for protection status.
  3. Form-C contacts rated at 2 A and 24-V ac , one normally open and one normally closed, for remote monitoring of protection status.
  4. Surge counter.
- D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA . The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
  2. Line to Ground: 1200 V for 480Y/277 V 1200 V for 208Y/120 V.
  3. Line to Line: 2000 V for 480Y/277 V 1000 V for 208Y/120 V.
- F. SCCR: Equal or exceed 200 kA .
- G. Nominal Rating: 20 kA.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long and short time adjustments.
    - d. Ground-fault pickup level, time delay, and I squared t response.
  3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  4. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
    - c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - d. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."

## 2.5 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
1. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
    - d. Megawatts: Plus or minus 1 percent.
    - e. Megavars: Plus or minus 1 percent.
    - f. Power Factor: Plus or minus 1 percent.
    - g. Frequency: Plus or minus 0.1 percent.
    - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.

- i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

## 2.6 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

## 2.8 IDENTIFICATION

- A. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.
- B. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.
- C. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NECA 400 .
  1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
  2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
  3. Protect from moisture, dust, dirt, and debris during storage and installation.
  4. Install temporary heating during storage per manufacturer's instructions.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install switchboards and accessories according to NECA 400 .
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to switchboards.
  - 6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.
- C. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
- E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- F. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- G. Install filler plates in unused spaces of panel-mounted sections.
- H. Install overcurrent protective devices, surge protection devices, and instrumentation.
  - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- I. Comply with NECA 1.



### 3.3 CONNECTIONS

- A. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.
- B. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.
- C. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.
- D. Support and secure conductors within the switchboard according to NFPA 70.
- E. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

### 3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Acceptance Testing:
    - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    - b. Test continuity of each circuit.
  - 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
  - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Perform the following infrared scan tests and inspections, and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front and rear panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
  - c. Instruments and Equipment:
    - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated.

### 3.7 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

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. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### 1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

#### 1.10 FIELD CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
  - b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

### 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  1. Panelboard Warranty Period: 18 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
  1. SPD Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Surface-mounted, dead-front cabinets.
  1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1 .

- b. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, .
        2. Height: 84 inches maximum.
        3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
        4. Finishes:
          - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
          - b. Back Boxes: Galvanized steel .
- G. Incoming Mains:
  1. Location: Convertible between top and bottom.
  2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
  1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
  1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
  1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
  2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards 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."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

## 2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. Schneider Electric USA (Square D).
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. G.E. (General Electric)
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker .
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers .
- F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. Schneider Electric USA (Square D).
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. G.E. (General Electric)
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
- F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. Schneider Electric USA (Square D).
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. G.E. General Electric
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 4. Subfeed Circuit Breakers: Vertically mounted.
  - 5. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Ground-Fault Protection: relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - g. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
    - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.



## 2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Comply with NECA 1.
  - C. Install panelboards and accessories according to NEMA PB 1.1.
  - D. Equipment Mounting:
    - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
    - 2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
  - E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
  - F. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
  - G. Mount top of trim 90 inches above finished floor unless otherwise indicated.
  - H. Mount panelboard cabinet plumb and rigid without distortion of box.
  - I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
  - J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
  - K. Install overcurrent protective devices and controllers not already factory installed.
    - 1. Set field-adjustable, circuit-breaker trip ranges.
    - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
  - L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
  - M. Install filler plates in unused spaces.
  - N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
  - O. Mount spare fuse cabinet in accessible location.
- 3.3 IDENTIFICATION
- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
  - B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage . Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
  - 1. Measure loads during period of normal facility operations.
  - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
  - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

### 3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Standard-grade receptacles, 125 V, 20 A.
  - 2. GFCI receptacles, 125 V, 20 A.
  - 3. Twist-locking receptacles.
  - 4. Toggle switches, 120/277 V, 20 A.
  - 5. Wall plates.
  - 6. Service poles.

#### 1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.5 INFORMATIONAL SUBMITTALS

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Essential Electrical System: Red .
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A :
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Eaton (Wiring Devices - Arrow Hart).
    - b. Hubbell Incorporated (Wiring Device-Kellems).
    - c. Legrand North America, LLC (Pass & Seymour).
    - d. Leviton Manufacturing Co., Inc.
  - 2. Description: Two pole, three wire, and self-grounding.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.
- B. Weather-Resistant Duplex Receptacle, 125 V, 20 A :

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498.
5. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

### 2.3 GFCI RECEPTACLES, 125 V, 20 A

#### A. Duplex GFCI Receptacles, 125 V, 20 A :

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

#### B. Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A :

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Type: through.
5. Standards: Comply with UL 498 and UL 943 Class A.
6. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" articles.

2.4 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, 120V:

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Standards: Comply with UL 498.

B. Twist-Lock, Single Receptacles, 250V:

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Hubbell Premise Wiring).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Configuration: NEMA configuration as noted on drawings.
3. Standards: Comply with UL 498.

2.5 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A :

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Standards: Comply with UL 20 and FS W-S-896.

B. Three-Way Switches, 120/277 V, 20 A :

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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Comply with UL 20 and FS W-S-896.

C. Four-Way Switches, 120/277 V, 20 A :



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. Eaton (Wiring Devices - Arrow Hart).
  - b. Hubbell Incorporated (Wiring Device-Kellems).
  - c. Legrand North America, LLC (Pass & Seymour).
  - d. Leviton Manufacturing Co., Inc.
2. Standards: Comply with UL 20 and FS W-S-896.

## 2.6 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Smooth, high-impact thermoplastic .
  3. Material for Unfinished Spaces: Galvanized steel Smooth, high-impact thermoplastic.
  4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant , die-cast aluminum with lockable cover.

## 2.7 SERVICE POLES

- A. Dual-Channel Service Poles :
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated (Hubbell Premise Wiring).
    - b. Panduit Corp.
  2. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
  3. Poles: Nominal 2.5-inch- square cross-section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
  4. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
  5. Material: Aluminum .
  6. Finishes: Satin-anodized aluminum.
  7. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.
  8. Power Receptacles: Two duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
  9. Data Communication Outlets: Four RJ-45 jacks, complying with requirements in Section 271513 "Communications Copper Horizontal Cabling."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.
  - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

- E. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles up , and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

### 3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Perform the following tests and inspections:
  - 1. In healthcare facilities, prepare reports that comply with NFPA 99.
  - 2. Test Instruments: Use instruments that comply with UL 1436.
  - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
  - E. Prepare test and inspection reports.

END OF SECTION 262726

## SECTION 262813 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
  - a. Enclosed switches.
2. Spare-fuse cabinets.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  2. Coordination charts and tables and related data.
  3. Fuse sizes for elevator feeders and elevator disconnect switches.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Ambient temperature adjustment information.
  2. Current-limitation curves for fuses with current-limiting characteristics.
  3. Coordination charts and tables and related data.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

## 1.6 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F , apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton (Bussmann & Edison).
  - 2. Littelfuse, Inc.
  - 3. Mersen USA.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
  - 1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC , time delay.
  - 2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC , time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

### 2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
  - 1. Motor Branch Circuits: Class RK1 Class RK5 , time delay.
  - 2. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

#### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Owner.

#### 3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

## 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. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Molded-case switches.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include wiring diagrams for power, signal, and control wiring.



1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers 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. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
    - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.7 QUALITY ASSURANCE

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

### 2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

### 2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB (Electrification Products Division).
  - 2. Eaton.
  - 3. Schneider Electric USA (Square D).
  - 4. Siemens Industry, Inc., Energy Management Division.
- B. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Three pole.
  - 3. 600-V ac.
  - 4. 200 A and smaller.
  - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
  - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.4 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB (Electrification Products Division).
  2. Eaton.
  3. Schneider Electric USA (Square D).
  4. Siemens Industry, Inc., Energy Management Division.
- B. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.5 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton (Bussmann & Edison).
  2. Littelfuse, Inc.
  3. Mersen USA.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.
- C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: [240] 600-V ac, 100 <Insert amperage> A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, pilot, indicating and control devices.
- E. Accessories:
1. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  2. Form C alarm contacts that change state when switch is tripped.

3. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
4. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
5. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

## 2.6 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB (Electrification Products Division).
  2. Eaton.
  3. NOARK Electric North America.
  4. Schneider Electric USA (Square D).
  5. Siemens Industry, Inc., Energy Management Division.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated .
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below .
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.
- I. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

## 2.7 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB (Electrification Products Division).
  - 2. Eaton.
  - 3. NOARK Electric North America.
  - 4. Schneider Electric USA (Square D).
  - 5. Siemens Industry, Inc., Energy Management Division.
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- D. Features and Accessories:
  - 1. Standard frame sizes and number of poles.
  - 2. Lugs:
    - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
    - b. Lugs shall be suitable for 140 deg F rated wire on 125-A circuit breakers and below .

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.2 PREPARATION

### 3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

### 3.4 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    - i. Verify correct phase barrier installation.
    - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
  - 2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
  - a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
  - b. Inspect physical and mechanical condition.
  - c. Inspect anchorage, alignment, grounding, and clearances.
  - d. Verify that the unit is clean.
  - e. Operate the circuit breaker to ensure smooth operation.
  - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
    - 1) Use a low-resistance ohmmeter.
      - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
      - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
  - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
  - h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
  - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of

- manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
  - e. Determine the following by primary current injection:
    - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
  - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
  - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
  - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
  - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  4. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.



- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
  - 1. Test procedures used.
  - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges to values indicated on the Drawings.

END OF SECTION 262816

## SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

### 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. Type 2 surge protective devices.
  - 2. Conductors and cables.
- B. Related Requirements:
  - 1. Section 262413 "Switchboards" for integral SPDs installed by switchboard manufacturer.
  - 2. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.
  - 3. Section 262726 "Wiring Devices" for integral SPDs installed by receptacle manufacturer.

#### 1.3 DEFINITIONS

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: air of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- E. NRTL: Nationally recognized testing laboratory.
- F. OCPD: Overcurrent protective device.
- G. SCCR: Short-circuit current rating.
- H. SPD: Surge protective device.
- I. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
- J. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

- K. Type 3 SPDs: Point of utilization SPDs.
- L. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.
- M. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- N. VPR: Voltage protection rating.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include electrical characteristics, specialties, and accessories for SPDs.
  - 2. NRTL certification of compliance with UL 1449.
    - a. Tested values for VPRs.
    - b. Inominal ratings.
    - c. MCOV, type designations.
    - d. OCPD requirements.
    - e. Manufacturer's model number.
    - f. System voltage.
    - g. Modes of protection.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

#### 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton.
  - 2. Liebert; a brand of Vertiv.

3. Schneider Electric USA, Inc.
4. Siemens Industry, Inc., Energy Management Division.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. Standards:

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.
2. Comply with UL 1283.

D. Product Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at 2 A and 24 V ac for remote monitoring of protection status.
4. Include surge counter.

E. Performance Criteria:

1. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
2. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than 200 kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
3. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V 208Y/120 V, three-phase, four-wire circuits must not exceed the following:
  - a. Line to Neutral: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
  - b. Line to Ground: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
  - c. Neutral to Ground: 1200 V for 480Y/277 V 700 V for 208Y/120 V.
  - d. Line to Line: 2000 V for 480Y/277 V 1200 V for 208Y/120 V.
4. SCCR: Equal or exceed 100 200 kA.
5. Inominal Rating: 20 kA.

## 2.2 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Comply with NECA 1.

- B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.
- C. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's written instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
  - 2. Do not exceed manufacturer's recommended lead length.
  - 3. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
  - 2. Inspect anchorage, alignment, grounding, and clearances.
  - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. SPDs that do not pass tests and inspections will be considered defective.
- C. Prepare test and inspection reports.

### 3.3 STARTUP SERVICE

- A. Complete startup checks in accordance with manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313

## SECTION 265119 - LED INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Exit Signs.
  - 2. Downlight.
  - 3. Linear industrial.
  - 4. Recessed, linear.
  - 5. Strip light.
  - 6. Suspended, linear.
  - 7. Materials.
  - 8. Luminaire support.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.

5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests , complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project .
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of luminaire.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

- B. Provide luminaires from a single manufacturer for each luminaire type.

- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance:
  - 1. Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 .
  - 2. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. Altitude: Sea level to 1000 feet .

2.2 LUMINAIRE REQUIREMENTS

- A. Manufacturer and Type: as indicated on Lighting Fixture Schedule.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- D. Recessed luminaires shall comply with NEMA LE 4.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. California Title 24 compliant.

2.3 MATERIALS

- A. Metal Parts:



1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

## 2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage .
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
  - 1. Attached to a minimum 20 gauge backing plate attached to wall structural members .
  - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:
  - 1. Ceiling Mount:
    - a. Two 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length .
    - b. Pendant mount with 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length .
    - c. Hook mount.
  - 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Luminaire Lighting Controls."

B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

## SECTION 265619 - LED EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Luminaire types.
  - 2. Materials.
  - 3. Finishes.
  - 4. Luminaire support components.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaire.
  - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project .

- a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
- b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
  2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Provide luminaires from a single manufacturer for each luminaire type.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including luminaire support components.
    - b. Faulty operation of luminaires and accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance:
  - 1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .
  - 2. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. CRI of 80 . CCT as indicated on Lighting Fixture Schedule .
- F. L70 lamp life of 50,000 hours.
- G. Internal driver.
- H. Nominal Operating Voltage: 277 V ac .
- I. In-line Fusing: Separate in-line fuse for each luminaire.
- J. Lamp Rating: Lamp marked for outdoor use .

K. Source Limitations:

1. Obtain luminaires from single source from a single manufacturer.
2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 LUMINAIRE TYPES

A. Area and Site:

1. Manufacturer and Type: as indicated on Lighting Fixture Schedule.
2. Luminaire-Mounting Height: as indicated on Lighting Fixture Schedule and drawings .

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum . Form and support to prevent warping and sagging.

C. 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.

D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. 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.

F. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
  - a. "USE ONLY" and include specific lamp type.
  - b. Lamp diameter, shape, size, wattage and coating.
  - c. CCT and CRI for all luminaires.



## 2.5 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.

3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to a minimum 1/8 inch backing plate attached to wall structural members .

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.4 INSTALLATION OF BOLLARD LUMINAIRES

- A. Align units for optimum directional alignment of light distribution.

### 3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.7 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections:
  1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Verify operation of photoelectric controls.

- C. Luminaire will be considered defective if it does not pass tests and inspections.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### 3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

### 3.9 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265619

## SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Grounding conductors.
  - 2. Grounding connectors.

#### 1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. TGB: Telecommunications grounding busbar.
- C. Service Provider: The operator of a service that provides telecommunications transmission delivered over access provider facilities.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
  - 1. Ground rods.
  - 2. Ground and roof rings.
  - 3. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Result of the ground-resistance test, measured at the point of BCT connection.
    - b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician , who shall be present at all times when Work of this Section is performed at Project site.
  - 2. Field Inspector: Currently registered by BICSI as Technician to perform the on-site inspection.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Comply with TIA-607-B.

### 2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Harger Lightning & Grounding.
  - 2. Panduit Corp.
  - 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
  - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

2. Cable Tray Equipment Grounding Wire: No. 6 AWG.

D. Cable Tray Grounding Jumper:

1. Not smaller than No. 6 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
4. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.3 CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products, Inc.
2. Harger Lightning & Grounding.
3. Panduit Corp.
4. TE Connectivity Ltd.

B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

C. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

## 2.4 GROUNDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Chatsworth Products, Inc.
2. Harger Lightning & Grounding.
3. Panduit Corp.

B. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 x 4 inches in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.

2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
  3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- C. Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-607-B. Predrilling shall be with holes for use with lugs specified in this Section.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with TIA-607-B.

#### 3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
  1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
  2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.

- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
- D. Conductor Support:
  - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches.
- E. Grounding and Bonding Conductors:
  - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
  - 2. Install without splices.
  - 3. Support at not more than 36-inch intervals.
  - 4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
    - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

### 3.4 GROUNDING ELECTRODE SYSTEM

### 3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.
- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

### 3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
  - 1. Use crimping tool and the die specific to the connector.
  - 2. Pretwist the conductor.



3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
- F. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- G. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
    - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
  3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
    - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.
- D. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 270526

## SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Optical-fiber-cable pathways and fittings.
  - 4. Tele-power poles.
  - 5. Hooks.
  - 6. Boxes, enclosures, and cabinets.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid conduit.
- C. IMC: Intermediate metal conduit.
- D. RTRC: Reinforced thermosetting resin conduit.

#### 1.4 ACTION SUBMITTALS

- A. Product data for the following:
  - 1. Surface pathways
  - 2. Wireways and fittings.
  - 3. Tele-power poles.
  - 4. Boxes, enclosures, and cabinets.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Data: Seismic rating Provide seismic bracing for all pathway racks, enclosures, cabinets, equipment racks, and their mounting provisions, including those for internal 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 certification is based and their installation requirements.
  4. Detailed description of conduit support devices and interconnections on which certification is based and their installation requirements.
- B. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

- A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ABB (Electrification Products Division).
  2. Alpha Wire.
  3. Atkore International (Allied Tube & Conduit).
  4. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
- C. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
  2. Comply with TIA-569-D.
- D. GRC: Comply with ANSI C80.1 and UL 6.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
  2. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Set screw or compression.
  3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
  4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Description: Nonmetallic raceway of circular section with manufacturer-fabricated fittings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ABB (Electrification Products Division).
  - 2. Atkore International (Allied Tube & Conduit).
  - 3. Carlon; a brand of Thomas & Betts Corporation.
  - 4. Hubbell Incorporated (Raco Taymac Bell).
- C. General Requirements for Nonmetallic Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  - 2. Comply with TIA-569-D.
- D. RNC: Type EPC-40-PVC , complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Fittings: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway with a circular cross section, approved for general-use installation unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alpha Wire.
  - 2. Carlon; a brand of Thomas & Betts Corporation.
  - 3. Dura-Line.
  - 4. Endot Industries Inc.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.

2.4 TELE-POWER POLES:

- A. Description: Prefabricated, finished metal pole with prewired power and communications outlets.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Legrand North America, LLC (Wiremold).
  - 2. MonoSystems, Inc.
  - 3. Panduit Corp.
- C. Material: Aluminum with clear anodized finish.
- D. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.
- E. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- F. Comply with TIA-569-D.

2.5 HOOKS

- A. Description: Prefabricated sheet metal cable supports for telecommunications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Legrand North America, LLC (Wiremold).
  - 2. MonoSystems, Inc.
  - 3. Panduit Corp.
- C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with TIA-569-D.
- E. Galvanized steel.
- F. J shape.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Description: Enclosures for communications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ABB (Electrification Products Division).
2. Carlon; a brand of Thomas & Betts Corporation.
3. Legrand North America, LLC (Wiremold).
4. MonoSystems, Inc.

C. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-D.
2. Boxes, enclosures, and cabinets installed in wet locations shall be listed and labeled as defined in NFPA 70, by an NRTL, and marked for use in wet locations.
3. Gangable boxes are .

D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

## 2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-40-PVC .
2. Concealed Conduit, Aboveground: GRC .
3. Underground Conduit: RNC, Type EPC-40-PVC , direct buried .
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R .

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT .
2. Exposed and Subject to Severe Physical Damage: GRC . Pathway locations include the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

- c. Mechanical rooms.
  - d. Gymnasiums
  - 3. Concealed in Ceilings and Interior Walls and Partitions: EMT or innerduct.
  - 4. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT .
  - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch trade size for copper and aluminum cables, and 1 inch for optical-fiber cables.
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
- 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use set-screw or compression , cast-metal fittings. Comply with NEMA FB 2.10.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F .

### 3.2 INSTALLATION

- A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:
- 1. NECA 1.
  - 2. NECA/BICSI 568.
  - 3. TIA-569-D.
  - 4. NECA 101
  - 5. NECA 102.
  - 6. NECA 105.
- B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.
- E. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling" for sleeves and sleeve seals for communications.

- F. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- G. Complete pathway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.
- J. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches of enclosures to which attached.
- L. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for pathways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- P. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- S. Install pull wires in empty pathways. 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. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.
- T. Surface Pathways:
  - 1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
  - 2. Install surface pathway with a minimum 2-inch radius control at bend points.
  - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section.



Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

- U. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
  
- V. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.
  
- W. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service pathway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
  
- X. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
  
- Y. Expansion-Joint Fittings:
  - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
  - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.
3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.
4. Space hooks no more than 5 feet o.c.
5. Provide a hook at each change in direction.

AA. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

BB. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe of less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12

inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete around conduit for a minimum of 12 inches on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 270553 "Identification for Communications Systems."

### 3.4 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

### 3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or deterioration.
  1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 270528

## SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Steel slotted support systems for communication raceways.
- 2. Conduit and cable support devices.
- 3. Support for conductors in vertical conduit.
- 4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

- B. Related Requirements:

- 1. Section 270548 "Seismic Controls for Communications Systems" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - a. Slotted support systems, hardware, and accessories.
  - b. Clamps.
  - c. Hangers.
  - d. Sockets.
  - e. Eye nuts.
  - f. Fasteners.
  - g. Anchors.
  - h. Saddles.
  - i. Brackets.
- 2. Include rated capacities and furnished specialties and accessories.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for communications hangers and support systems.

- 1. Trapeze hangers. Include product data for components.
- 2. Steel slotted-channel systems.

3. Aluminum slotted-channel systems.
4. Nonmetallic slotted-channel systems.
5. Equipment supports.
6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for communications systems.

1. Include design calculations and details of trapeze hangers.
2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Flame Rating: Class 1.
  2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.
  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. ABB (Electrification Products Division).
    - b. Atkore International (Allied Tube & Conduit).
    - c. Atkore International (Unistrut).
    - d. Eaton (B-line).
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel .
  4. Channel Width: Selected for applicable load criteria .
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  8. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c., in at least one surface.
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. Atkore International (Allied Tube & Conduit).
    - b. Eaton (B-line).
    - c. G-Strut.
    - d. Haydon Corporation.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channel Width: Selected for applicable load criteria .
  4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
  5. Fitting and Accessory Materials: Same as those for channels and angles , except metal items may be stainless steel.
  6. Rated Strength: Selected to suit applicable load criteria.
  7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Conduit and Cable Support Devices: Steel clamps, hangers, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored communications conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Eaton (B-line).
    - 2) Hilti, Inc.
    - 3) ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - 4) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 .
6. Toggle Bolts: Stainless-steel springhead type.
7. Hanger Rods: Threaded steel.

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  1. NECA 1.
  2. NECA/BICSI 568.
  3. TIA-569-D.
  4. NECA 101.
  5. NECA 105.
- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by scheduled in NECA 1, where its Table 1 lists maximum

spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps .
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Raceway Support Methods: In addition to methods described in NECA 1, EMT RMC may be supported by openings through structure members, according to NFPA 70.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten communications items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To New Concrete: Bolt to concrete inserts.
  - 2. To Masonry: Use approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 3. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 .
  - 4. 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 comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor communications materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.



3.4 PAINTING

- A. Touchup: Comply with requirements in Section 099123 "Interior Painting" [**and**] for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

END OF SECTION 270529

## SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Round sleeves.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 ROUND SLEEVES

- A. Wall Sleeves, Steel:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, LLC.
    - b. CCI Piping Systems.
    - c. Flexicraft Industries.
    - d. GPT; an EnPro Industries company.
  - 2. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed.
  4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Underground, Exterior-Wall and Floor Penetrations:
1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
  2. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

END OF SECTION 270544

## SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Underground-line warning tape.
  - 2. Cable ties.
  - 3. Miscellaneous identification products.
  - 4. Labels.

#### 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 communications identification products.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 70 and TIA 606-B.

#### 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Equipment Identification Labels:
  - 1. Black letters on a white field.

#### 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

- B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. Manufacturers: Subject to compliance with requirements, undefined:
    - a. Brady Corporation.
    - b. LEM Products Inc.
    - c. Panduit Corp.
  - 2. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors.
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
  - 2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE" .
- C. Tag, Detectable: Type ID :
  - 1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
  - 2. Width: 3 inches.
  - 3. Overall Thickness: 5 mils.
  - 4. Foil Core Thickness: 0.35 mil.
  - 5. Weight: 28 lb/1000 sq. ft..
  - 6. Tensile according to ASTM D882: 70 lbf and 4600 psi.

## 2.5 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ideal Industries, Inc.
  - 2. Marking Services, Inc.

- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.

## 2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.
- G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6 inches from cable end.

I. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

J. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway 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.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

K. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION 270553

## SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

### 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. Backboards.

#### 1.3 DEFINITIONS

- A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
- B. BICSI: Building Industry Consulting Service International.
- C. RCDD: Registered communications distribution designer.
- D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- E. TGB: Telecommunications grounding bus bar.
- F. TMGB: Telecommunications main grounding bus bar.

#### 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 equipment racks and cabinets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD .
  2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
  3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment 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 when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

#### 2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.
- B. Backboard Paint: Light-colored interior latex paint.

### PART 3 - EXECUTION

#### 3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.
- C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.
  - 1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
  - 4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- G. Backboards:
  - 1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
  - 2. Paint all sides of backboard with two coats of paint , leaving fire rating stamp visible.
  - 3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

### 3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

### 3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

END OF SECTION 271100

## SECTION 271116 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

### 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. 19-inch equipment racks.
  - 2. Open Rack equipment racks.
  - 3. Grounding.

#### 1.3 DEFINITIONS

- A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
- B. BICSI: Building Industry Consulting Service International.
- C. LAN: Local area network.
- D. RCDD: Registered communications distribution designer.
- E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- F. TGB: Telecommunications grounding bus bar.
- G. TMGB: Telecommunications main grounding bus bar.

#### 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 equipment racks and cabinets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.
- B. Shop Drawings: For communications racks, frames, and enclosures. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of TGB and its mounting detail showing standoff insulators and wall-mounting brackets.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- B. Seismic Qualification Data: Certificates, 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. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD .
  2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
  3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Equipment 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 when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- B. UL listed.

- C. RoHS compliant.
- D. Compliant with requirements of the Payment Card Industry Data Security Standard.

## 2.2 19-INCH EQUIPMENT RACKS

- A. Description: Two- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch equipment mounting with an opening of 17.72-inches between rails.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Belden Inc.
  - 2. CommScope, Inc.
  - 3. Eaton (B-line).
  - 4. Hubbell Incorporated (Hubbell Premise Wiring).
  - 5. Legrand North America, LLC (Middle Atlantic Products).
  - 6. Leviton Manufacturing Co., Inc.
  - 7. Ortronics, Inc.
  - 8. Panduit Corp.
- C. General Requirements:
  - 1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
  - 2. Material: Extruded steel .
  - 3. Finish: Manufacturer's standard, baked-polyester powder coat.
  - 4. Color: Black .
- D. Floor-Mounted Racks:
  - 1. Overall Height: 72 inches .
  - 2. Overall Depth: 23 inches .
  - 3. Upright Depth: 3 inches .
  - 4. Two-Post Load Rating: .
  - 5. Number of Rack Units per Rack: 42 .
    - a. Numbering: Every rack units, on interior of rack.
  - 6. Threads: 10-32 .
  - 7. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug , and a power strip.
  - 8. Base shall have a minimum of four mounting holes for permanent attachment to floor.
  - 9. Top shall have provisions for attaching to cable tray or ceiling.
  - 10. Self-leveling.
- E. Cable Management:
  - 1. Metal, with integral wire retaining fingers.
  - 2. Baked-polyester powder coat finish.
  - 3. Vertical cable management panels shall have front and rear channels, with covers.

4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

### 2.3 OPEN RACK EQUIPMENT RACKS

- A. Description: Four-post racks with integral bus bars, equipment support, and dimensions meeting Open Rack Standard v1.2.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Penguin Computing.
  2. Quanta Cloud Technology.
- C. General Requirements:
  1. Frames: Four vertical columns, with perforated top and bottom.
  2. Support Shelves: Designed to support equipment 1 OpenU (48 mm) in height.
  3. Material:
    - a. Frames and Shelves: Extruded steel .
    - b. Bus Bars: Nickel plated copper , with silver over-plating .
  4. Finish:
    - a. Frames: Manufacturer's standard, baked-polyester powder coat.
    - b. Shelves: Hot-dip galvanized according to ASTM A 653/A 653M.
  5. Color: Black .
  6. Height: 2100 mm.
  7. Width: 600 mm.
  8. Depth: 1607 mm.
  9. Base shall have a minimum of four for permanent attachment to floor.
  10. Top shall have provisions for attaching to cable tray or ceiling.
  11. Self-leveling.

### 2.4 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Chatsworth Products, Inc.
  2. Harger Lightning & Grounding.
  3. Panduit Corp.
- C. Rack and Cabinet TGBs: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with TIA-606-B. Predrilling shall be with holes for use with lugs specified in this Section.

1. Cabinet-Mounted TGB: Terminal block, with stainless-steel or copper-plated hardware for attachment to cabinet.
2. Rack-Mounted Horizontal TGB: Designed for mounting in 19- or 23-inch equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.
3. Rack-Mounted Vertical TGB: 72 or 36 inches long, with stainless-steel or copper-plated hardware for attachment to rack.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout of communications equipment spaces.
- C. Comply with BICSI ITSIMM for installation of communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

### 3.2 GROUNDING

- A. Comply with NECA/BICSI 607.
- B. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Ch.
- C. Locate TGB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind TGB. Connect TGB with a minimum No. 4 AWG grounding electrode conductor from TGB to suitable electrical building ground. Connect rack TGB to near TGB or the TMGB.
  1. Bond the shield of shielded cable to patch panel, and bond patch panel to TGB or TMGB.

### 3.3 IDENTIFICATION

- A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 270553 "Identification for Electrical Systems."
- B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.



D. Labels shall be machine printed. Type shall be 1/8 inch in height.

END OF SECTION 271116

## SECTION 271323 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. 62.5/125-micrometer, multimode, optical fiber cable (OM1).
2. 50/125 micrometer, multimode, optical fiber cable (OM2).
3. Optical fiber cable connecting hardware, patch panels, and cross-connects.
4. Cabling identification products.

#### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. RCDD: Registered Communications Distribution Designer.

#### 1.4 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

- A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Wiring diagrams to show typical wiring schematics including the following:
  - a. Telecommunications rooms plans and elevations.
  - b. Telecommunications pathways.
  - c. Telecommunications system access points.
  - d. Telecommunications grounding system.
  - e. Cross-connects.
  - f. Patch panels.
  - g. Patch cords.
5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, installation supervisor, and field inspector.
- B. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For optical fiber cable, splices, and connectors to include in maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
  2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
  3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set .

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

#### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- 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: 50 or less.
- C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- D. Grounding: Comply with TIA-607-B.

#### 2.2 62.5/125-MICROMETER, MULTIMODE, OPTICAL FIBER CABLE (OM1)

- A. Description: Multimode, 62.5/125-micrometer, 12 -fiber, nonconductive, tight buffer, optical fiber cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Belden CDT Networking Division/NORDX.
  2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  3. CommScope, Inc.
  4. Corning Cable Systems.
  5. General Cable; General Cable Corporation.

6. Hitachi Cable America Inc.
7. Mohawk; a division of Belden Networking, Inc.
8. Superior Essex Inc.

C. Standards:

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAA for detailed specifications.

D. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.

E. Minimum Overfilled Modal Bandwidth-Length Product: 200 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

F. Jacket:

1. Jacket Color: Orange .
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

1. Riser Rated, Nonconductive: , complying with UL 1666.
2. Riser Rated, Nonconductive: Type OFNP or Type OFNR in listed riser or plenum communications raceway.

2.3 50/125 MICROMETER, MULTIMODE, OPTICAL FIBER CABLE (OM2)

A. Description: Multimode, 50/125-micrometer, 12 -fiber, nonconductive, tight buffer, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden CDT Networking Division/NORDX.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.
3. CommScope, Inc.
4. Corning Cable Systems.
5. General Cable; General Cable Corporation.
6. Hitachi Cable America Inc.
7. Superior Essex Inc.

C. Standards:

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAB for detailed specifications.

- D. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
- E. Minimum Overfilled Modal Bandwidth-length Product: 500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- F. Jacket:
  - 1. Jacket Color: Orange .
  - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
  - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.
- G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
  - 1. Riser Rated, Nonconductive: , complying with UL 1666.
  - 2. Riser Rated, Nonconductive: Type OFNP or Type OFNR in listed riser or plenum communications raceway.

#### 2.4 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Belden CDT Networking Division/NORDX.
  - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 3. Corning Cable Systems.
  - 4. Hubbell Incorporated (Hubbell Premise Wiring).
- B. Standards:
  - 1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
  - 2. Comply with TIA-568-C.3.
- C. Connector Type: Type ST complying with TIA-604-2-B, connectors.

#### 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

#### 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test multimode optical fiber cables according to TIA-526-14-B and TIA-568-C.3.

- C. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

#### 3.2 WIRING METHODS

- A. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

#### 3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

- A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.
- B. General Requirements for Optical Fiber Cabling Installation:
  - 1. Comply with TIA-568-C.1 and TIA-568-C.3.
  - 2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
  - 3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
  - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 9. In the communications equipment room, provide a 10-foot- long service loop on each end of cable.

10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Group connecting hardware for cables into separate logical fields.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
  1. Administration Class: Class 2 .
  2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
- C. Comply with requirements in Section 271523 "Communications Optical Fiber Horizontal Cabling" for cable and asset management software.
- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets,



backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:

1. Flexible vinyl or polyester that flexes as cables are bent.

### 3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:
  - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  - b. Link End-to-End Attenuation Tests:
    - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
    - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.

- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271323

## SECTION 271333 - COMMUNICATIONS COAXIAL BACKBONE CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. CATV coaxial cable.
  - 2. Grounding.
  - 3. Identification products.

#### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.

#### 1.4 COAXIAL BACKBONE CABLING DESCRIPTION

- A. Coaxial cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities.

### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Nominal OD.
  - 2. Minimum bending radius.
  - 3. Maximum pulling tension.
- B. Shop Drawings:
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  - 3. Cabling administration drawings and printouts.

### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, installation supervisor, and field inspector.
- B. Field quality-control reports.
- C. Maintenance Data: For splices and connectors to include in maintenance manuals.

### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coaxial cable, splices, and connectors to include in maintenance manuals.

### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings by a Technician.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each coaxial cable on the reel for continuity.

### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining

ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard, and the requirements of TIA-568-C.4.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

#### 2.2 GENERAL CABLE CHARACTERISTICS

- A. CATV Cable: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. CATV Plenum Rated: Type CATVP installed in riser raceways or cable routing assemblies, complying with NFPA 262.
  - 2. CATV Riser Rated: Type CATVR complying with UL 1666 ; or CATVP complying with NFPA 262 installed in riser raceways or cable routing assemblies.
  - 3. CATV Cable: Type CATV , or CATVP or CATVR installed in general purpose, riser, or plenum communications raceways or cable routing assemblies in fireproof riser shafts with firestops at each penetration.

#### 2.3 CATV COAXIAL CABLE

- A. Description: Coaxial cable with a 75-ohm characteristic impedance designed for CATV transmission.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alpha Wire.
  - 2. Belden CDT Networking Division/NORDX.
  - 3. Coleman Cable, Inc.
  - 4. CommScope, Inc.
  - 5. Prysmian Group North America.

- C. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Community Antenna Television and Radio Distribution" Article. Types are as follows:
  - 1. RG-6/U: UL Type CATVR.
    - a. No. 18 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
    - b. Riser rated.
    - c. Gas-injected, foam-PE insulation.
    - d. Shielded with 100 percent aluminum tape and 40 percent aluminum braid.
    - e. Jacketed with black PVC or PE.
    - f. Suitable for indoor installations.

## 2.4 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Comply with requirements specified in Section 271100 "Communications Equipment Room Fittings." Comply with requirements in Section 270528 "Pathways for Communications Systems" for installation of conduits and wireways.
- B. Comply with Section 270528.29 "Hangers and Supports for Communications Systems."
- C. Drawings indicate general arrangement of pathways and fittings.
- D. Comply with NFPA 70 for pull-box sizing and length of conduit and number of bends between pull points.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF COAXIAL BACKBONE CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
  - 1. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.
  - 3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

4. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend coaxial cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.



3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
  1. Administration Class: Class 2 .
  2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect coaxial jacket materials for NRTL certification markings.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test coaxial backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271333

## SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Category 6a twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Cable management system.
4. Cabling identification products.
5. Grounding provisions for twisted pair cable.
6. Source quality control requirements for twisted pair cable.

#### 1.3 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unshielded twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

#### 1.4 COPPER HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Reviewed and stamped by RCDD.
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  - 3. Cabling administration Drawings and printouts.
  - 4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
    - a. Telecommunications rooms plans and elevations.
    - b. Telecommunications pathways.
    - c. Telecommunications system access points.
    - d. Telecommunications grounding system.
    - e. Telecommunications conductor drop locations.
    - f. Typical telecommunications details.
    - g. Mechanical, electrical, and plumbing systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, installation supervisor, and field inspector.
- B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and cabling administration Drawings by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

### 2.2 GENERAL CABLE CHARACTERISTICS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. Communications, Non-plenum: Type CMR complying with UL 1666.
  - 2. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.
  - 3. Communications, Non-plenum: Type CMP or Type CMR in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
- 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: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. RoHS compliant.

### 2.3 CATEGORY 6a TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 2. Mohawk; a division of Belden Networking, Inc.
  - 3. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP) .

- F. Cable Rating: Riser .
- G. Jacket: Blue thermoplastic.

#### 2.4 TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 2. Mohawk; a division of Belden Networking, Inc.
  - 3. Panduit Corp.
  - 4. SYSTIMAX Solutions; a CommScope Inc. brand.
- C. General Requirements for Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 6a .
  - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.
- E. Connecting Blocks:
  - 1. 110-style IDC for Category 6a.
  - 2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
  - 1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 24 or 48 ports.
  - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
  - 3. Number of Jacks per Field: One for each four-pair cable indicated .
- H. Jacks and Jack Assemblies:



1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

I. Faceplate:

1. port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. Metal Faceplate: Stainless steel , complying with requirements in Section 262726 "Wiring Devices."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
  - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

J. Legend:

1. Machine printed, in the field, using adhesive-tape label.

## 2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.6 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.7 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.2 INSTALLATION OF PATHWAYS

- A. Comply with requirements for demarcation point, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings."
- B. Comply with Section 270528 "Pathways for Communications Systems."
- C. Comply with Section 270529 "Hangers and Supports for Communications Systems."
- D. Comply with Section 270536 "Cable Trays for Communications Systems."
- E. Drawings indicate general arrangement of pathways and fittings.

### 3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
  - 2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
  - 5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 6. MUTOA shall not be used as a cross-connect point.
  - 7. Consolidation points may be used only for making a direct connection to equipment outlets:

- a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
  - b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.
  8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
  10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
  11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
  12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  13. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
  14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
  2. Install cabling after the flooring system has been installed in raised floor areas.
  3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with "Firestopping Systems" Article in BICSI's "Telecommunications Distribution Methods Manual."

### 3.5 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
  1. Administration Class: Class 2 .

2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2 level of administration.
  - C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
  - D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
  - E. Cable and Wire Identification:
    1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
    2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
    3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
    4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
      - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      - b. Label each unit and field within distribution racks and frames.
    5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
  - F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
    1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
  - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271513

## SECTION 271533 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. CATV coaxial cable.
  - 2. Coaxial cable hardware.
  - 3. Grounding.
  - 4. Identification products.

#### 1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

#### 1.4 COAXIAL HORIZONTAL CABLING DESCRIPTION

- A. Coaxial horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C and the equipment outlet, otherwise known as "Cabling Subsystem 1" in the telecommunications cabling system structure. Cabling system consists of horizontal cables, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Nominal OD.
  - 2. Minimum bending radius.
  - 3. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, installation supervisor, and field inspector.
- B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coaxial cable, splices, and connectors to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  1. Layout Responsibility: Preparation of Shop Drawings by an Technician.
  2. Installation Supervision: Installation shall be under the direct supervision of Technician , who shall be present at all times when Work of this Section is performed at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  1. Test each coaxial cable on the reel for continuity.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard, and the requirements of TIA-568-C.4.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

### 2.2 GENERAL CABLE CHARACTERISTICS

- A. CATV Cable: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. CATV Plenum Rated: Type CATVP installed in riser raceways or cable routing assemblies, complying with NFPA 262.
  - 2. CATV Cable: Type CATV , or CATVP or CATVR installed in general purpose, riser, or plenum communications raceways or cable routing assemblies in fireproof riser shafts with firestops at each penetration.

### 2.3 CATV COAXIAL CABLE

- A. Description: Coaxial cable with a 75-ohm characteristic impedance designed for CATV transmission.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alpha Wire.
  - 2. Belden CDT Networking Division/NORDX.
  - 3. Coleman Cable, Inc.
  - 4. CommScope, Inc.
- C. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Community Antenna Television and Radio Distribution Systems" Article. Types are as follows:
  - 1. RG-6/U: UL Type CATVP.
    - a. No. 18 AWG, solid, copper-covered steel conductor.
    - b. Plenum rated.
    - c. Gas-injected, foam-PE insulation.
    - d. Shielded with 100 percent aluminum tape and 40 percent aluminum braid.
    - e. Jacketed with black PVC or PE.
    - f. Suitable for indoor installations.

## 2.4 COAXIAL CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate coaxial cable with a 75-ohm characteristic impedance.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Emerson Network Power Connectivity Solutions.
  - 2. Leviton Manufacturing Co., Inc.
  - 3. Siemon Co. (The).
- C. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- D. Faceplates:
  - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
  - 2. Metal Faceplate: Stainless steel , complying with requirements in Section 262726 "Wiring Devices."
  - 3. For use with snap-in jacks accommodating any combination of twisted pair, optical-fiber, and coaxial work area cords.
    - a. Flush-mounted jacks, positioning the cord at a 90-degree angle from faceplate surface.

## 2.5 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.6 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.7 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES

- A. Coordinate horizontal cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Comply with Section 271100 "Communications Equipment Room Fittings." Comply with requirements in Section 270528 "Pathways for Communications Systems" for installation of conduits and wireways.
- B. Comply with Section 270528.29 "Hangers and Supports for Communications Systems."
- C. Drawings indicate general arrangement of pathways and fittings.
- D. Comply with NFPA 70 for pull-box sizing and length of conduit and number of bends between pull points.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.4 INSTALLATION OF COAXIAL HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:

1. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.
3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling Cable" Section. Monitor cable pull tensions.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend coaxial cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

E. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating Between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - 1. Administration Class: Class 2 .
  - 2. Color-code fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, horizontal pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- D. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communications cabling, use a different color for jacks and plugs of each service.
- E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA 606-B, for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.

- B. Tests and Inspections:
  - 1. Visually inspect coaxial jacket materials for NRTL certification markings.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test coaxial horizontal copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 271533

## SECTION 281300 - ACCESS 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 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans and details.
  - 1. Installation diagrams.
  - 2. Wiring Diagrams. System and component wiring diagram. Show typical wiring schematics.
- C. Samples: For indoor stations, outdoor stations, modules, and system components.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain central station, workstations, controllers, Identifier readers, and all software through one source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70, "National Electrical Code."
- D. Manufacturer Qualifications: ISO 9001:2008 Certified company.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide hardware by RS2, furnished and installed (including all cabling and connections) by Architectural Sales, Inc.

#### 2.2 DESCRIPTION

- A. General System Characteristics.



1. System Wiring: Single pair non-polarized wiring.
2. Outdoor Stations:
  - a. Modular and non-modular (Mini-OS).
  - b. IP54 and IK07 rated.
  - c. Providing up to 18 V and 4 A to power door lock.
3. System Capacity:
  - a. System capable of accommodating up to 250 different addresses (apartments) within an isolated system.
4. System Components: Made of UL94V0 material.
5. System Controller: Serves primary power source for a system.
6. Keypad Password: Individually customized at outdoor station with a keypad module to allow or disallow operator access to program functions for each location.
7. System shall be capable of monitoring and reporting door status.
8. System shall have App available for both IOS and Android Operating Systems to allow remote monitoring of, and control of, outdoor stations.

B. Components:

1. Outdoor Stations: Factory assembled or field assembled from modules.
2. Indoor Stations.
3. Guard Stations.
4. Switch Actuators.
5. System Components:
  - a. System controller.
  - b. Switch actuators.
  - c. Gateway.
  - d. IP Gateway.

- C. Integrating smart devices (iOS™ and Android™) requires access to mobile data network or WiFi. The appropriate APP also has to be installed on the device.

## 2.3 OPERATION

- A. Security access system shall use a single database for access-control and credential-creation functions.

B. System Configured to Facilitate:

1. Calling indoor station from outdoor station and communicating.
2. Calling guard station from outdoor station and communicating.
3. Calling indoor station from indoor station and communicating.
4. Calling guard station from indoor station and communicating.
5. Calling outdoor station and indoor station from mobile application.
6. Unlocking electric doors from indoor stations, outdoor stations, guard stations, connected mobile devices, and connected telephones.
7. Monitoring surveillance cameras.
8. Sending emergency messages from indoor stations to guard stations.
9. Granting access in case of emergency.
10. Granting access control and output access data (via display module).

11. TCP/IP integration linking allowing globalization of audio, video, and access control via Ethernet interface to local area network (LAN) or wide area network (WAN).
12. Calling, door, and programmable control via existing PBX based telephone systems via available analog extension on central telephone system exchange.

C. Number of Locations:

1. Isolated System: Supporting up to 250 addresses.
2. Single system capable of being configured to have up to 69 different isolated sub-systems.
3. Single indoor station capable of being linked to up to 9 different outdoor stations within same system.

D. System Capacity:

1. 250 addresses (apartments) per isolated system.
2. Up to 9 outdoor stations can be linked to indoor station.
3. 60 isolated systems can be networked.
4. Keypad Module: 6000 unique 3-8 character passcodes.
5. Card Reader Module: 3000 ID or IC cards can be registered per card reader.

E. System Network Requirements:

1. Single pair wiring components.
2. Connections to wireless network (LAN) or data network is required to integrate smart devices (iOS™ and Android™) to the system.

F. Door Hardware Interface:

1. Comply with requirements in Section 087100 "Door Hardware" and Section 087111 "Door Hardware (Descriptive Specification)" for door hardware required to be monitored or controlled by the security access system.
2. Electrical characteristics of system shall match the signal and power requirements of door hardware.
  - a. Outdoor Station: Provide up to 18V DC 4A impulsive, 250 mA holding, to drive door locks; and 30V DC 1A for NC or NO operations.
  - b. Switch Actuator: Capable of switching 120V AC or 30V DC 4A circuits.

2.4 OUTDOOR STATIONS:

A. General Characteristics:

1. Outdoor Stations: Modular construction, IP54 or equivalent.
2. Outdoor stations and its modules shall be powered by its associated system controller or auxiliary power supply.
3. Outdoor stations shall call residents and guard stations.
4. Mounting: Flush mounted or surface mounted.
5. Capable of unlocking up to 2 door locks.
6. Single outdoor station provides 12V DC, 250 mA (18V DC, 4A impulsive) to power to an electric door lock.

7. Outdoor stations shall be backlit.

B. Modules:

1. Camera Module:
  - a. 104 degree viewing angle.
  - b. Adjustable by up to 15 degrees horizontally or vertically.
  - c. Allows integration of CCTV inputs.
  - d. Equipped with infrared to illuminate objects in low light.
  - e. Equipped with anti-fog mechanism.
2. Camera Extension Unit Module:
  - a. 104 degree viewing angle.
  - b. Adjustable by up to 15 degrees horizontally or vertically.
  - c. Equipped with infrared to illuminate objects in low light.
  - d. Equipped with anti-fog mechanism.
3. Audio Module:
  - a. Voice Synthesis: Optional.
  - b. Pushbutton: Options available.
4. Display and Card Reader Module:
  - a. Compatible with either ID (125 kHz) or IC (13.65 MHz) cards.
  - b. Output: 26 bit and 33 bit weigand output.
  - c. Card reader shall also open door locks.
  - d. Digital visual indicator shall provide visible and audible status indications and user prompts. Indicate whether user passage requests have been accepted or rejected, and whether the door is unlocked.
5. Keypad Module:
  - a. Memory: Store up to 3000 names in memory.
  - b. Calling Codes: Supporting up to 6 digit calling codes.
  - c. Customized Passwords: Allowing up to 6000 customized passwords.
  - d. Able to be configured with a PC via USB port.
  - e. Equipped with progressive sorting as input is entered.
  - f. Allows direct communication with guard station.
  - g. Unlocks door when correct code is entered.
6. Push Button Module:
  - a. Types: One-, two-, three-, or four-button versions.
  - b. Customization: Three- and four-button modules shall accommodate up to 6 or 8 individual addresses respectively. Each button shall be configurable to call two unit addresses or functions.
  - c. Round Button Modules: One, two, and three round button modules can be ordered with NFC and IC (13.56 MHz) card reader options.
  - d. Backlighting: Provide backlighting to ensure clear visibility in low light conditions.
7. Custom Configuration Modules:
  - a. Allows use of custom pushbuttons.
  - b. Scalable up to 99 buttons.
  - c. Addressing can be either physical or logical.
  - d. Camera Extension Unit Module:
    - 1) 104 degree viewing angle.
    - 2) Adjustable by up to 15 degrees horizontally or vertically.
    - 3) Equipped with infrared to illuminate objects in low light.
    - 4) Equipped with anti-fog mechanism.

- e. Audio Integration Unit and Extension Unit:
  - 1) Allows connection of 8 custom pushbuttons.
  - 2) Normally closed relay output.
  - 3) First two buttons can be configured for light control and guard unit notification.
- f. Extension Unit:
  - 1) Scalable to allow more up to 99 custom pushbuttons.

C. Non-Modular:

- 1. 1. Mini-Outdoor Stations:
  - a. Surface Mount, three, 11/16 inch x 6-10/16 inch x 1 inch.
  - b. One button and two button options.
  - c. Optional built-In ID reader.
  - d. First button is configurable in two-button station.
  - e. Connections available for two locks.
  - f. General call feature at outdoor station allows for room-to-room communications.
  - g. Fixed viewing angle, 104 degrees.
  - h. Manual adjustments for speaker and door lock release time.

2.5 INDOOR STATIONS

A. General Characteristics:

- 1. Indoor stations and its modules shall be powered by its associated system controller or auxiliary power.
- 2. Each address can have an unlimited number on indoor stations provided adequate power is provided and only one is set as a master while the rest are set to slave mode.

B. 7 inch Touch Screen Hands-Free Indoor Station.

- 1. Color display: 7 inch with intuitive touch control.
- 2. Functions:
  - a. Communicate with other apartments, outdoor station, and guard station.
  - b. Communicate with iOS and Android smart devices through mobile app.
  - c. Connects to up to 9 outdoor stations.
  - d. Optional induction loop available.
  - e. Records visitor images automatically on an external SD card.
  - f. Call forwarding.
  - g. May be connected as a doorbell.
  - h. Scroll through connected CCTV cameras.
  - i. Blacklist unwanted callers.
  - j. Leave away message for visitors.
  - k. Visitors can leave voicemail.
  - l. Sends emergency messages to guard unit.
  - m. Multi-function Programmable Button.
- 3. Mounting: Table Surface.
- 4. Color: Black .

C. 4.3 inch Video Hand's Free Indoor Station.

1. Color display: 4.3 inch with 480 X 272 pixel resolution.
  2. Functions:
    - a. Communicate with other apartments, outdoor station, and guard station.
    - b. Communicate with iOS and Android smart devices through mobile app.
    - c. Connects to up to 9 outdoor stations.
    - d. Optional induction loop available.
    - e. Controls up to 199 actuators.
    - f. Storage: Up to 50 images.
    - g. May be used to extend the doorbell function
    - h. Able to forward calls to other addresses.
    - i. Scroll through connected CCTV cameras.
    - j. Blacklist unwanted calls from other addresses.
    - k. Sends emergency messages to guard unit.
    - l. Multi-function Programmable Button.
  3. Mounting: or Surface.
  4. Replacement Face Cover Colors: Black .
- D. 4.3 inch Video Hand's Free Basic Indoor Station.
1. Color display: 4.3 inch with 480 X 272 pixel resolution.
  2. Functions:
    - a. Communicate with outdoor station, and guard station.
    - b. Communicate with iOS and Android smart devices through mobile app.
    - c. Connects to up to 9 outdoor stations.
    - d. Controls up to 199 actuators.
    - e. Storage: Up to 50 images.
    - f. May be used to extend the doorbell function
    - g. Scroll through connected CCTV cameras.
    - h. Sends emergency messages to guard unit.
    - i. Multi-function Programmable Button.
  3. Mounting: Surface.
  4. Color: White.
- E. 4.3 inch Video Hand's Free Basic Indoor Station.
1. Color display: 4.3 inch with 480 X 272 pixel resolution.
  2. Functions:
    - a. Communicate with outdoor station, and guard station.
    - b. Communicate with iOS and Android smart devices through mobile app.
    - c. Connects to up to 9 outdoor stations.
    - d. Controls up to 199 actuators.
    - e. Storage: Up to 50 images.
    - f. May be used to extend the doorbell function
    - g. Scroll through connected CCTV cameras.
    - h. Sends emergency messages to guard unit.
    - i. Multi-function Programmable Button.
  3. Mounting: Surface.
  4. Color: White
- F. 4.3 inch Video Handset Indoor Station.

1. Color display: 4.3 inch with 480 X 272 pixel resolution.
2. Functions:
  - a. Communicate with other apartments, outdoor station, and guard station.
  - b. Automatically records 2 images of each visitor when a call is received from an outdoor station.
  - c. Communicate with iOS and Android smart devices through mobile app.
  - d. Connects to up to 9 outdoor stations.
  - e. Optional induction loop available.
  - f. Controls up to 199 actuators.
  - g. Storage: Up to 25 images.
  - h. May be used to extend the doorbell function
  - i. Able to forward calls to other addresses.
  - j. Scroll through connected CCTV cameras.
  - k. Blacklist unwanted calls from other addresses.
  - l. Sends emergency messages to guard unit.
  - m. Two Multi-function Programmable Buttons.
3. Mounting: Table Surface.
4. Color: White.

G. Audio Hands-Free Indoor Station.

1. Hands-free device.
2. Functions:
  - a. Communicate with other apartments, outdoor station, and guard station.
  - b. Communicate with iOS and Android smart devices through mobile app.
  - c. Controls up to 199 actuators.
  - d. Can call transfer to guard unit or other addresses.
  - e. LED status indicators.
  - f. Unlock doors.
  - g. Programmable buttons.
  - h. Communicate with outdoor station.
  - i. Ringtones: 5.

2.6 GUARD STATIONS

- A. Guard units shall be powered by associated system controller or auxiliary power supply.
- B. Equipped with Audio handset and Video touchscreen display.
- C. Able to call by name or apartment number.
- D. Capable of controlling up to 199 actuators.
- E. Capable of communicating directly with outdoor stations. Able to screen all or a subset of residents' incoming calls.
- F. Capable of unlocking doors.
- G. Mounting: Wall mounted or to table mounted.

- H. Units shall store missed calls and alarm messages.

## 2.7 SYSTEM COMPONENTS

- A. Made from UL94 V0 rated materials.
- B. Components shall be din rail mountable.
- C. Complying with UL-60950-1 standard for information technology equipment safety.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
- B. Examine roughing-in for LAN and control cable conduit systems to PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with recommendations in SIA CP-01.
- B. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

### 3.3 CABLING

- A. Comply with NECA 1, "Good Workmanship in Electrical Construction."
- B. Install cables and wiring according to requirements in Section 280513 "Conductors and Cables for Electronic Safety and Security."
- C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

### 3.4 SYSTEM SOFTWARE AND HARDWARE

- A. Install and test hardware for the complete and proper operation of systems involved. Assign software license to Owner.

3.5 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. Devices and circuits will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured with an activated burglar alarm and access-control system reporting to a central station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

END OF SECTION 281300



## SECTION 284621.11 - ADDRESSABLE FIRE-ALARM 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. Existing fire-alarm system to be modified.
2. Addressable fire-alarm system.
3. Fire-alarm control unit (FACU).
4. Manual fire-alarm boxes.
5. System smoke detectors.
6. Duct smoke detectors.
7. Projected beam smoke detectors.
8. Carbon monoxide detectors.
9. Heat detectors.
10. Fire-alarm notification appliances.
11. Firefighters' two-way telephone communication service.
12. Fire-alarm graphic annunciators.
13. Fire-alarm remote annunciators.
14. Fire-alarm addressable interface devices.
15. Fire-alarm radio transmitters.
16. Video smoke detection.

- B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables"

#### 1.3 ACTION SUBMITTALS

- A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.
- B. Product Data: For each type of product, including furnished options and accessories.
  1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  2. Include rated capacities, operating characteristics, and electrical characteristics.
- C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Graphic Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include input/output matrix.
7. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
  - a. Locate detectors in accordance with manufacturer's written instructions.
8. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

#### 1.4 INFORMATIONAL SUBMITTALS

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
    - a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
- B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On USB media and approved online or cloud solution.
  3. Device address list.

4. Printout of software application and graphic screens.

## 1.6 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level II technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

## 1.7 WARRANTY

### A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ADDRESSABLE FIRE-ALARM SYSTEM

#### A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.

#### B. Performance Criteria:

1. Regulatory Requirements:
  - a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.
2. General Characteristics:
  - a. Automatic sensitivity control of certain smoke detectors.
  - b. Fire-alarm signal initiation must be by one or more of the following devices and systems:
    - 1) Manual stations.
    - 2) Heat detectors.
    - 3) Smoke detectors.
    - 4) Duct smoke detectors.
    - 5) Automatic sprinkler system water flow.
  - c. Fire-alarm signal must initiate the following actions:
    - 1) Continuously operate alarm notification appliances.
    - 2) Identify alarm and specific initiating device at FACU and remote annunciators.

- 3) Transmit alarm signal to remote alarm receiving station.
  - 4) Release fire and smoke doors held open by magnetic door holders.
  - 5) Activate voice/alarm communication system.
  - 6) Switch HVAC equipment controls to fire-alarm mode.
  - 7) Recall elevators to primary or alternate recall floors.
  - 8) Activate elevator power shunt trip.
  - 9) Record events in system memory.
  - 10) Indicate device in alarm on graphic annunciator.
- d. Supervisory signal initiation must be by one or more of the following devices and actions:
- 1) Alert and Action signals of air-sampling detector system.
  - 2) Elevator shunt-trip supervision.
  - 3) Zones or individual devices have been disabled.
  - 4) FACU has lost communication with network.
- e. System trouble signal initiation must be by one or more of the following devices and actions:
- 1) Open circuits, shorts, and grounds in designated circuits.
  - 2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  - 3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  - 4) Loss of primary power at FACU.
  - 5) Ground or single break in internal circuits of FACU.
  - 6) Abnormal ac voltage at FACU.
  - 7) Break in standby battery circuitry.
  - 8) Failure of battery charging.
  - 9) Abnormal position of switch at FACU or annunciator.
  - 10) Voice signal amplifier failure.
  - 11) Hose cabinet door open.
- f. System Supervisory Signal Actions:
- 1) Initiate notification appliances.
  - 2) Identify specific device initiating event at FACU and remote annunciators.
  - 3) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
  - 4) Display system status on graphic annunciator.
- g. Network Communications:
- 1) Provide network communications for fire-alarm system in accordance with fire-alarm manufacturer's written instructions.
  - 2) Provide network communications pathway per manufacturer's written instructions and requirements in NFPA 72 and NFPA 70.
  - 3) Provide integration gateway using for connection to building automation system.
- h. Document Storage Box:
- 1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
  - 2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
  - 3) Color: Red powder-coat epoxy finish.

- 4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
- 5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

## 2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bosch Security Systems, Inc.
2. Honeywell International (Fire-Lite Alarms).
3. Honeywell International (Honeywell Gamewell-FCI).
4. Siemens Industry, Inc. (Building Technologies Division).
5. Tyco International (Johnson Controls - Autocall).
6. Tyco International (Johnson Controls - SimplexGrinnell).

B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:
  - a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
  - b. Include real-time clock for time annotation of events on event recorder and printer.
  - c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
  - d. FACU must be listed for connection to central-station signaling system service.
  - e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
  - f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.
    - 1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.
  - g. Alphanumeric Display and System Controls: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.
    - 1) Annunciator and Display: LCD, three line(s) of 40 80 characters, minimum.
    - 2) Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into system for control of smoke-detector sensitivity and other parameters.
  - h. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
    - 1) Pathway Class Designations: NFPA 72, Class B .

- 2) Pathway Survivability: Level 0 .
- 3) Install no more than 50 addressable devices on each signaling-line circuit.
- 4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.
- i. Serial Interfaces:
  - 1) One dedicated RS 485 port for central-station operation using point ID DACT.
  - 2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
  - 3) One USB port for PC configuration.
  - 4) One RS 232 port for air-aspirating smoke detector connection.
  - 5) One RS 232 port for voice evacuation interface.
- j. Notification-Appliance Circuit:
  - 1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
  - 2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
  - 3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.
- k. Elevator Recall: Initiate by one of the following alarm-initiating devices:
  - 1) Elevator lobby detectors except lobby detector on designated floor.
  - 2) Smoke detectors in elevator machine room.
  - 3) Smoke detectors in elevator hoistway.
- l. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.
- m. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.
  - 1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.
- n. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls must be connected to fire-alarm system.
- o. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
- p. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as special module that is part of FACU.
- q. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.
  - 1) Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
  - 2) Programmable tone and message sequence selection.
  - 3) Standard digitally recorded messages for "Evacuation" and "All Clear."
  - 4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of FACU.

- r. Status Annunciator: Indicate status of various voice/alarm speaker zones and status of firefighters' two-way telephone communication zones.
- s. Preamplifiers, amplifiers, and tone generators must automatically transfer to backup units, on primary equipment failure.
- t. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate printing of list of existing alarm, supervisory, and trouble conditions in system and historical log of events.
- u. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals must be powered by 24 V(dc) source.
- v. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
- w. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.
- x. Batteries: Vented, wet-cell pocket, plate nickel cadmium.

D. Accessories:

- 1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.
- 2. Preaction System Functionality:
  - a. Initiate Presignal Alarm: This function must cause audible and visual alarm and indication to be provided at FACU. Activation of initiation device connected as part of preaction system must be annunciated at FACU only, without activation of general evacuation alarm.

### 2.3 MANUAL FIRE-ALARM BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Bosch Security Systems, Inc.
- 2. Honeywell International (Fire-Lite Alarms).
- 3. Honeywell International (Honeywell Gamewell-FCI).
- 4. Honeywell International (Notifier).
- 5. Siemens Industry, Inc. (Building Technologies Division).

B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

- 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.

2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm. Lifting cover actuates integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
5. Able to perform at up to 90 percent relative humidity at 90 deg F .
6. Material: Manual stations made of Lexan polycarbonate .
7. Able to be used in indoor areas.

## 2.4 SYSTEM SMOKE DETECTORS

### A. Photoelectric Smoke Detectors:

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. Bosch Security Systems, Inc.
  - b. Honeywell International (Fire-Lite Alarms).
  - c. Honeywell International (Honeywell Gamewell-FCI).
  - d. Honeywell International (Notifier).
  - e. Siemens Industry, Inc. (Building Technologies Division).
2. Performance Criteria:
  - a. Regulatory Requirements:
    - 1) NFPA 72.
    - 2) UL 268.
  - b. General Characteristics:
    - 1) Detectors must be two-wire type.
    - 2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
    - 3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
    - 4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
    - 5) Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
    - 6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
    - 7) Operator at FACU, having designated access level, must be able to manually access the following for each detector:
      - a) Primary status.
      - b) Device type.
      - c) Present average value.
      - d) Present sensitivity selected.
      - e) Sensor range (normal, dirty, etc.).
    - 8) Detector must have functional humidity range within 10 to 90 percent relative humidity.
    - 9) Color: White .



- 10) Remote Control: Unless otherwise indicated, detectors must be digital-addressable type, individually monitored at FACU for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by FACU.
- 11) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
- 12) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
- 13) Multiple levels of detection sensitivity for each sensor.
- 14) Sensitivity levels based on time of day.

## 2.5 DUCT SMOKE DETECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bosch Security Systems, Inc.
2. Honeywell International (Fire-Lite Alarms).
3. Honeywell International (Honeywell Gamewell-FCI).
4. Honeywell International (Notifier).
5. Siemens Industry, Inc. (Building Technologies Division).

B. Description: Photoelectric-type, duct-mounted smoke detector.

C. Performance Criteria:

1. Regulatory Requirements:
  - a. NFPA 72.
  - b. UL 268A.
2. General Characteristics:
  - a. Detectors must be four two-wire type.
  - b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
  - c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - d. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  - e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
  - f. Operator at FACU, having designated access level, must be able to manually access the following for each detector:
    - 1) Primary status.
    - 2) Device type.
    - 3) Present average value.
    - 4) Present sensitivity selected.
    - 5) Sensor range (normal, dirty, etc.).
  - g. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
  - h. Each sensor must have multiple levels of detection sensitivity.

- i. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- j. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.6 HEAT DETECTORS

### A. Combination-Type Heat Detectors:

- 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. Bosch Security Systems, Inc.
  - b. Honeywell International (Fire-Lite Alarms).
  - c. Honeywell International (Honeywell Gamewell-FCI).
  - d. Honeywell International (Notifier).
  - e. Siemens Industry, Inc. (Building Technologies Division).
- 2. Performance Criteria:
  - a. Regulatory Requirements:
    - 1) NFPA 72.
    - 2) UL 521.
  - b. General Characteristics:
    - 1) Temperature sensors must test for and communicate sensitivity range of device.
  - c. Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
  - d. Mounting: Adapter plate for outlet box mounting .
  - e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
  - f. Detector must have functional humidity range of 10 to 90 percent relative humidity.
  - g. Color: White .

## 2.7 FIRE-ALARM NOTIFICATION APPLIANCES

### A. Fire-Alarm Audible Notification Appliances:

- 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. Honeywell International (Notifier).
  - b. Siemens Industry, Inc. (Building Technologies Division).
- 2. Description: Horns, bells, or other notification devices that cannot output voice messages.
- 3. Performance Criteria:
  - a. Regulatory Requirements:
    - 1) NFPA 72.
  - b. General Characteristics:
    - 1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

- 2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
- 3) Chimes, Low-Level Output: Vibrating type, 75 dB(A-weighted) minimum rated output.
- 4) Chimes, High-Level Output: Vibrating type, 81 dB(A-weighted) minimum rated output.
- 5) Sounders, High Volume 24 V(dc): Less than 6 mA of alarm current.
- 6) Sounders, Low Volume 24 V(dc): Less than 4 mA of alarm current.
- 7) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
- 8) ISO Temporal 3 Evacuation Tone: 90 plus or minus 4 dB(A-weighted) at 24 V.
- 9) ISO Temporal 3 Alert Tone: 95 plus or minus 5 dB(A-weighted) at 24 V.
- 10) AS2220 Evacuation Tone: 93 plus or minus 4 dB(A-weighted) at 24 V.
- 11) AS2220 Alert Tone: 93 plus or minus 5 dB(A-weighted) at 24 V.
- 12) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.
- 13) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Voice/Tone Notification Appliances:

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. Honeywell International (Notifier).
  - b. Siemens Industry, Inc. (Building Technologies Division).
2. Description: Notification appliances capable of outputting voice evacuation messages.
3. Performance Criteria:
  - a. Regulatory Requirements:
    - 1) NFPA 72.
    - 2) UL 1480.
  - b. General Characteristics:
    - 1) Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
    - 2) High-Range Units: Rated 2 to 15 W.
    - 3) Low-Range Units: Rated 1 to 2 W.
    - 4) Mounting: Flush .
    - 5) Matching Transformers: Tap range matched to acoustical environment of speaker location.
    - 6) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

C. Fire-Alarm Visible Notification Appliances:

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. Honeywell International (Notifier).
  - b. Siemens Industry, Inc. (Building Technologies Division).
2. Performance Criteria:
  - a. Regulatory Requirements:
    - 1) NFPA 72.
    - 2) UL 1971.
  - b. General Characteristics:
    - 1) Rated Light Output:
      - a) 15/30/75/110 cd, selectable in field.
    - 2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
    - 3) Mounting: Wall mounted unless otherwise indicated.
    - 4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
    - 5) Flashing must be in temporal pattern, synchronized with other units.
    - 6) Strobe Leads: Factory connected to screw terminals.
    - 7) Mounting Faceplate: Factory finished, red .

## 2.8 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Honeywell International (Honeywell Gamewell-FCI).
  2. Honeywell International (Notifier).
- B. Description: Dedicated, two-way, supervised, telephone voice communication links between FACU and remote firefighters' telephone stations. Supervised telephone lines must be connected to talk circuits by controls in control module.
- C. Performance Criteria:
  1. Regulatory Requirements:
    - a. NFPA 72.
  2. General Characteristics:
    - a. Common-talk type for firefighter use only.
    - b. Selective-talk type for use by firefighters and fire wardens.
    - c. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. Indicator lamp must flash if phone is disconnected from talk circuits.
    - d. Addressable firefighters' phone modules to monitor and control loop of firefighter phones. Module must be capable of differentiating between normal, off-hook, and trouble conditions.
    - e. Audible Pulse and Tone Generator, and High-Intensity Lamp: When remote telephone is taken off hook, it causes audible signal to sound and high-intensity lamp to flash at FACU .

- f. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on panel front by individual LEDs.
- g. Display: Graphic to indicate location of caller.
- h. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated; factory-standard red finish; with handset.
  - 1) Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Emergency Phone."
  - 2) With "break-glass" door access lock.
- i. Remote Telephone Jack Stations: Single-gang, stainless steel-plate mounted plug, engraved "Fire Emergency Phone."
- j. Handsets: two push-to-talk sets stored in cabinet adjacent to FACU in fire command center.

## 2.9 FIRE-ALARM GRAPHIC ANNUNCIATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Mircom Technologies, Ltd.
  - 2. Siemens Industry, Inc. (Building Technologies Division).
- B. Performance Criteria:
  - 1. Regulatory Requirements:
    - a. NFPA 72.
  - 2. General Characteristics:
    - a. Graphic Annunciator Panel: Mounted in aluminum frame with nonglare, minimum 3/16 inch thick, clear acrylic cover over graphic representation of facility. Detector locations must be represented by red LED lamps. Normal system operation must be indicated by lighted, green LED. Trouble and supervisory alarms must be represented by amber LED.
      - 1) Comply with UL 864.
      - 2) Operating voltage must be 24 V(dc) provided by local 24 V power supply provided with annunciator.
      - 3) Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and lamp test switch.
      - 4) mounted in NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
      - 5) Graphic representation of facility must be CAD drawing and each detector must be represented by LED in its actual location. CAD drawing must be at 1:96 scale or larger.
      - 6) LED representing detector must flash two times per second while detector is in alarm.

## 2.10 FIRE-ALARM REMOTE ANNUNCIATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bosch Security Systems, Inc.
- B. Performance Criteria:
1. Regulatory Requirements:
    - a. NFPA 72.
  2. General Characteristics:
    - a. Annunciator functions must match those of FACU for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACU, including acknowledging, silencing, resetting, and testing.
      - 1) Mounting: Surface cabinet, NEMA 250, Type 1.
    - b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights must match those of FACU. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.11 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bosch Security Systems, Inc.
  2. Honeywell International (Notifier).
- B. Performance Criteria:
1. Regulatory Requirements:
    - a. NFPA 72.
  2. General Characteristics:
    - a. Include address-setting means on module.
    - b. Store internal identifying code for control panel use to identify module type.
    - c. Listed for controlling HVAC fan motor controllers.
    - d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.
    - e. Integral Relay: Capable of providing direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown .
      - 1) Allow control panel to switch relay contacts on command.
      - 2) Have minimum of two normally open and two normally closed contacts available for field wiring.
    - f. Control Module:
      - 1) Operate notification devices.
      - 2) Operate solenoids for use in sprinkler service.
      - 3) .

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.
- B. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

#### 3.3 INSTALLATION OF EQUIPMENT

- A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before other trades have completed cleanup must be replaced.
  - 2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connect new equipment to existing control panel in existing part of building.
  - 2. Connect new equipment to existing monitoring equipment at supervising station.
  - 3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- D. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
  2. Mount manual fire-alarm box on background of contrasting color.
  3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.
- E. Smoke- and Heat-Detector Spacing:
1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  3. Smooth ceiling spacing must not exceed 30 ft. .
  4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A or Annex B in NFPA 72.
  5. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
  6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- H. Air-Sampling Smoke Detectors: If using multiple pipe runs, runs must be pneumatically balanced.
- I. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- J. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within dwelling or suite, they must be connected so that operation of smoke alarm causes alarm in smoke alarms to sound.
- K. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- L. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.



- M. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.
- N. Device Location-Indicating Lights: Locate in public space near device they monitor.
- O. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists wind load of 100 mph with gust factor of 1.3 without damage.

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

### 3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

### 3.6 PATHWAYS

- A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.
  - 1. Exposed pathways located less than 96 inch above floor must be installed in EMT.
- B. Pathways must be installed in EMT.
- C. Exposed EMT must be painted red enamel.

### 3.7 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.
  - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
  - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
  - 3. Smoke dampers in air ducts of designated HVAC duct systems.
  - 4. Magnetically held-open doors.
  - 5. Electronically locked doors and access gates.
  - 6. Alarm-initiating connection to elevator recall system and components.
  - 7. Alarm-initiating connection to activate emergency lighting control.
  - 8. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 9. Supervisory connections at valve supervisory switches.
  - 10. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 11. Supervisory connections at elevator shunt-trip breaker.
  - 12. Data communication circuits for connection to building management system.
  - 13. Data communication circuits for connection to mass notification system.
  - 14. Supervisory connections at fire-extinguisher locations.
  - 15. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
  - 16. Supervisory connections at fire-pump engine control panel.
  - 17. .

### 3.8 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Install framed instructions in location visible from FACU.

### 3.9 GROUNDING

- A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Ground shielded cables at control panel location only. Insulate shield at device location.

### 3.10 FIELD QUALITY CONTROL

- A. Field tests must be witnessed by authorities having jurisdiction .
- B. Administrant for Tests and Inspections:
  - 1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    - b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.
  - 2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
  - 4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
  - 5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
  - 6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide video recording of training to Owner.

END OF SECTION 284621.11

## SECTION 312000 - EARTH MOVING

### 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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

##### B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" Section 013233 "Photographic Documentation" for recording preexcavation and earth-moving progress.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Section 316329 "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
5. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
6. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

#### 1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."
- B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

- C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
  - 1. 12 inches outside of concrete forms other than at footings.
  - 2. 12 inches outside of concrete forms at footings.
  - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - 5. 6 inches beneath bottom of concrete slabs-on-grade.
  - 6. 6 inches beneath pipe in trenches, and the greater of 12 inches wider than pipe or 42 inches wide.

#### 1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices changes in the Work.
  - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
  2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
  - J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
  - K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
  - L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
  - M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site 750 N. Black Branch Rd..
  1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
    - a. Personnel and equipment needed to make progress and avoid delays.
    - b. Coordination of Work with utility locator service.
    - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    - d. Extent of trenching by hand or with air spade.
    - e. Field quality control.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  1. Geotextiles.
  2. Controlled low-strength material, including design mixture.
  3. Warning tapes.

1.7 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D2487.
  - 2. Laboratory compaction curve according to ASTM D698.

1.8 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by Architect.
- C. Utility Locator Service: Notify utility locator service "Call Before You Dig" for area where Project is located before beginning earth-moving operations.
- D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.
- E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- F. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.



## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Liquid Limit: 40.
  - 2. Plasticity Index: 20.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C33/C33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Survivability: As follows:
    - a. Grab Tensile Strength: 247 lbf; ASTM D4632.
    - b. Sewn Seam Strength: 222 lbf; ASTM D4632.
    - c. Tear Strength: 90 lbf; ASTM D4533.
    - d. Puncture Strength: 90 lbf; ASTM D4833.
  - 3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
  - 4. Permittivity: 0.02 per second, minimum; ASTM D4491.
  - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

## 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
  - 1. Portland Cement: ASTM C150/C150M, Type I Type II or Type III.
  - 2. Fly Ash: ASTM C618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C33/C33M, 3/4-inch nominal maximum aggregate size.
  - 4. Foaming Agent: ASTM C869/C869M.
  - 5. Water: ASTM C94/C94M.
  - 6. Air-Entraining Admixture: ASTM C260/C260M.
- B. Produce low-density, controlled low-strength material with the following physical properties:
  - 1. As-Cast Unit Weight: 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C138/C138M.
  - 2. Compressive Strength: 140 psi, when tested according to ASTM C495/C495M.
- C. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C495/C495M.

## 2.4 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.
  
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
  - a. 24 inches outside of concrete forms other than at footings.
  - b. 12 inches outside of concrete forms at footings.
  - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - e. 6 inches beneath bottom of concrete slabs-on-grade.
  - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
  - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
  - a. 24 inches outside of concrete forms other than at footings.
  - b. 12 inches outside of concrete forms at footings.
  - c. 6 inches outside of minimum required dimensions of concrete cast against grade.

- d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
- e. 6 inches beneath bottom of concrete slabs-on-grade.
- f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
  3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
  1. Clearance: As indicated.

- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
  - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
  - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
  - 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

### 3.8 EXCAVATION FOR ELEVATOR CYLINDER

- A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Section 142400 "Hydraulic Elevators."
- B. Provide well casing as necessary to retain walls of well hole.

### 3.9 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
  - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring, bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.13 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely

encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

- E. Backfill voids with satisfactory soil while removing shoring and bracing.
- F. Initial Backfill:
  - 1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
    - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- G. Final Backfill:
  - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.14 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.15 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.



### 3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 98 percent.

### 3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, 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.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus 1/2 inch.
  - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.18 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.
  2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

### 3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  2. Place base course material over subbase course under hot-mix asphalt pavement.
  3. Shape subbase course and base course to required crown elevations and cross-slope grades.
  4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
  5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D698.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 98 percent of maximum dry unit weight according to ASTM D698.

### 3.20 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  2. Place drainage course 6 inches or less in compacted thickness in a single layer.

3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D698.

### 3.21 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  2. Determine that fill material classification and maximum lift thickness comply with requirements.
  3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
  4. .
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
  1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,500 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
  3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

## SECTION 315000 - EXCAVATION SUPPORT AND 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 temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
  - 2. Section 312000 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review geotechnical report.
  - 2. Review existing utilities and subsurface conditions.
  - 3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
  - 4. Review proposed excavations.
  - 5. Review proposed equipment.
  - 6. Review monitoring of excavation support and protection system.
  - 7. Review coordination with waterproofing.
  - 8. Review abandonment or removal of excavation support and protection system.

#### 1.4 ACTION SUBMITTALS

- A. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
  - 1. Land surveyor.

2. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the state in which Project is located.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

#### 1.6 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

#### 1.7 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than 14 days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Owner's written permission.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
3. Compliance with requirements of authorities having jurisdiction.
4. Compliance with utility company requirements.
5. Compliance with railroad requirements.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
  - 1. Shore, support, and protect utilities encountered.

### 3.2 INSTALLATION - GENERAL

- A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

### 3.3 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation.
  - 1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
  - 2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
  - 3. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds.
  - 1. Trim excavation as required to install lagging.
  - 2. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.4 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.
  - 1. Limit vertical offset of adjacent sheet piling to 60 inches.
  - 2. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- C. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.5 BRACING

- A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
  - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 MAINTENANCE

- A. Monitor and maintain excavation support and protection system.
- B. Prevent surface water from entering excavations by grading, dikes, or other means.
- C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

### 3.7 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.
  - 1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
  - 2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.



- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.8 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.
  - 1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 2. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction, and abandon remainder.
  - 3. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earth Moving."
  - 4. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

## SECTION 321216 - ASPHALT PAVING

### 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. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt paving.

##### B. Related Requirements:

1. Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
5. Section 321400 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.

#### 1.3 UNIT PRICES

- A. Provide unit prices as specified in the bid documents.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
  - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
  - 3. Job-Mix Designs: For each job mix proposed for the Work.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of KY DOT for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Prime Coat: Minimum surface temperature of 60 deg F.
  - 2. Tack Coat: Minimum surface temperature of 60 deg F.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242/D 242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

## 2.2 ASPHALT MATERIALS

- A. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397/D 2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- B. Water: Potable.

## 2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled asphalt shingles from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

## 2.4 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10Insert value&gt; percent or more than 15 percent by weight.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Base Course: See details sheet C6.0.
  - 3. Surface Course: See details sheet C6.0.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.

- B. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
  - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

### 3.3 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth of 1-1/2 inches.
  - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
  - 3. Control rate of milling to prevent tearing of existing asphalt course.
  - 4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
  - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
  - 6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
  - 7. Handle milled asphalt material according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
  - 8. Keep milled pavement surface free of loose material and dust.
  - 9. Do not allow milled materials to accumulate on-site.

### 3.4 REPAIRS

### 3.5 SURFACE PREPARATION

- A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

### 3.6 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  - 2. Place hot-mix asphalt surface course in single lift.
  - 3. Spread mix at a minimum temperature of 250 deg F.
  - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
  - 2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
  - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041/D 2041M, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch.
  - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch.
  - 2. Surface Course: 1/8 inch.

### 3.9 SURFACE TREATMENTS

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549/D 3549M.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979/D 979M or AASHTO T 168.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared

- according to ASTM D 2041/D 2041M, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726/D 2726M.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726/D 2726M.
  - F. Replace and compact hot-mix asphalt where core tests were taken.
  - G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 321216



## SECTION 321313 - CONCRETE PAVING

### 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 Concrete Paving

- 1. Driveways.
- 2. Roadways.
- 3. Parking lots.
- 4. Curbs and gutters.
- 5. Walks.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
- 2. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
- 3. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
- 4. Section 321713 "Parking Bumpers."
- 5. Section 321723 "Pavement Markings."
- 6. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles mats and pavers.
- 7. Section 321729 "Manufactured Traffic-Calming Devices."

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:

- a. Concrete mixture design.
  - b. Quality control of concrete materials and concrete paving construction practices.
  - c. .
2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
- a. Contractor's superintendent.
  - b. Independent testing agency responsible for concrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Concrete paving Subcontractor.
  - e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

#### 1.5 ACTION SUBMITTALS

- A. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer.

- B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

- C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

#### 1.7 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

1.8 PRECONSTRUCTION TESTING

1.9 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than percent.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from as-drawn steel wire into flat sheets.
- C. Plain-Steel Wire: ASTM A 1064/A 1064M,.
- D. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A; coated,.
- E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- G. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.
- H. Zinc Repair Material: ASTM A 780/A 780M.

## 2.4 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C 150/C 150M, gray portland cement Type I Type II Type I/II Type III Type V.
  - 2. Fly Ash: ASTM C 618,.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M,, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
1. Aggregate Sizes: 1/2 to 3/4 inch nominal.
  2. Aggregate Source, Shape, and Color: .
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
- G. Water: Potable and complying with ASTM C 94/C 94M.

## 2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

## 2.6 RELATED MATERIALS

- A. Joint Fillers: **[or]** in preformed strips.

## 2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Pozzolan: 25 percent.
  - 2. Slag Cement: 50 percent.
  - 3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content: 5-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
  - 2. Air Content: 6 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
  - 3. Air Content: 5 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use in concrete as required for placement and workability.
- F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- H. Concrete Mixtures: Normal-weight concrete.
  - 1. Compressive Strength (28 Days): 4000 psi.
  - 2. Maximum W/C Ratio at Point of Placement: 0.45.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
  - 4. Solar Reflectance Index: Not less than 29.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.
- F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.
- G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Provide tie bars at sides of paving strips where indicated.
  - 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  - 4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 35 feet unless otherwise indicated.
  - 2. Extend joint fillers full width and depth of joint.
  - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.



5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
    - a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.
- H. Screed paving surface with a straightedge and strike off.

- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
  - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.8 SPECIAL FINISHES

### 3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by curing compound or a combination of these as follows:
  - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.10 PAVING TOLERANCES

#### A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-feet- long; unlevelled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

### 3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- C. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- D. Concrete paving will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.12 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

## SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Cold-applied joint sealants.
- 2. Joint-sealant backer materials.

- B. Related Requirements:

- 1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Paving-Joint-Sealant Schedule: Include the following information:

- 1. Joint-sealant application, joint location, and designation.
- 2. Joint-sealant manufacturer and product name.
- 3. Joint-sealant formulation.
- 4. Joint-sealant color.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Certificates: For each type of joint sealant and accessory.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

## 1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

### 2.2 COLD-APPLIED JOINT SEALANTS

- A. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

### 2.3 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine joints 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: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or 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.

#### 3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint 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 joint-sealant backings.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
  - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
  - 1. Place joint sealants so they fully contact 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.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

### 3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. 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 and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

### 3.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Joints within concrete paving.
  1. Joint Location:
    - a. Expansion and isolation joints in concrete paving.
    - b. Contraction joints in concrete paving.
    - c. Other joints as indicated.
  2. Joint Sealant: Single component, pourable, urethane, elastomeric joint sealant.
  3. Joint-Sealant Color: To be selected by owner.

END OF SECTION 321373



## SECTION 321723 - PAVEMENT MARKINGS

### 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 painted markings applied to asphalt and concrete pavement.
- B. Related Requirements:
  - 1. Section 071800 "Traffic Coatings" for painting whole areas of building floors and pavements with coatings having an integral wearing surface.
  - 2. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement.
  - 3. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement.

#### 1.3 PREINSTALLATION MEETINGS

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.

#### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of KYDOT for pavement-marking work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials 55 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A.

### 2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

### 2.3 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.

1. Color: White Yellow As indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 2 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

## SECTION 334100 - STORM UTILITY DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.1 SUBMITTALS

A. Contractor shall submit detailed dimensional drawings showing placement of reinforcement steel, manufacturer and dimensions of item associated with the construction and installation of proposed storm utility drainage system.

### PART 2 - PRODUCTS

#### 2.1 SUITABLE STORM PIPING:

A. Concrete pipe shall be circular reinforced gasketed concrete pipe conforming to AASHTO M 170 (KDOT spec).

B. Corrugated metal pipe shall conform to ASTM A440 or AASHTO M218. Pipes and fittings shall be minimum 16 gauge for pipes 15" to 18" in diameter and 14 gauge for 24" and 30" pipes; but not less than gauges and sizes otherwise indicated on the Drawings. Each pipe shall be clearly marked to show class or gauge, date of manufacture, and name or trademark of the manufacturer. Joints for corrugated metal pipe, pipe arches and fittings shall be outside collars or coupling bands or galvanized steel angles riveted near the ends and bolted through the angles to draw the bands tight.

C. HDPE pipe and fitting production shall be high density polyethylene conforming with the minimum requirements of cell classification 424420C for 4- through 10-inch (100 to 250 mm) diameters, and 435400C for 12- through 60-inch (300 to 1500 mm) diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%. The 12- through 60-inch (300 to 1500mm) pipe material shall comply with the notched constant ligament-stress (NCLS) test as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively.

#### 2.2 BEDDING MATERIALS:

A. Crushed stone for bedding shall meet coarse aggregate conforming to Size No. 57 as set forth in Section 805 of the Kentucky Department of Highways Standard Specifications.

B. Sand for backfilling shall be comprised of sand or sand-gravel mixtures containing less than 30 percent passing a No. 40 sieve and less than 5 percent passing a No. 200 sieve. Sand or sand gravel mixtures shall classify as SW, SP, or GW and shall have a uniformity coefficient of 4.5 or more as set forth in ASTM D 2487.

#### 2.3 CASTINGS:

A. Casting shall meet the requirements of ASTM A-48 Standard Specification for Gray Iron Castings for Class No. 35-B, Gray Iron. Castings shall be manufactured by the Neenah Company, John Bouchard, JR Hoe or equal.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. After the trench is excavated to subgrade, it shall be filled to grade with crushed stone to provide a firm satisfactory bed, for the entire length of sewer pipe barrel. Pipe of the designated class and size shall be laid to form a closed joint with the next adjoining pipe, bringing inverts to the required line and grade shown on the drawings. The pipe shall be laid in an upstream direction with the bell or grove end upstream, unless otherwise permitted or directed.
- B. If in the opinion of the Engineer the subgrade of the storm sewer or is not suited for the bedding of the sewer pipe, he may order the Contractor to use additional crushed stone or concrete to cradle the pipe. The amount of additional crushed stone or concrete required shall be determined by the Engineer.
- C. The Contractor shall be responsible for sheeting or bracing pipe trenches where necessary to provide adequate protection for workers and adjacent improvements.
- D. Backfill of trenches shall be completed as soon as possible after the pipe is placed. The Contractor shall utilize compacted excavated or imported materials.
  - 1. Within the limits of pavement backfill shall consist of crushed stone installed to limit of subgrade.
  - 2. Outside the limits of pavement backfill shall consist of select excavated materials mechanically compacted.
- F. All inline drains and the slotted drain shall be constructed in accordance with the details shown on the plans and at the elevation and location indicated or established.
- G. All storm drainage installations shall be in accordance with all applicable storm drainage rules and regulations of the local or state agency of jurisdiction.

END OF SECTION 334100