

**LAKE SHORE CENTRAL SCHOOL DISTRICT  
CAPITAL IMPROVEMENT PROJECT 2023  
PHASE 3**

**LAKE SHORE HIGH SCHOOL  
959 BEACH ROAD  
ANGOLA, NY 14006  
SED # 14-14-01-06-0-001-024**

**WILLIAM G. HOUSTON MIDDLE SCHOOL  
8855 ERIE RD.  
ANGOLA, NY 14006  
SED # 14-14-01-06-0-015-019**

**PROJECT MANUAL**

**YOUNG + WRIGHT ARCHITECTURAL  
PROJECT # 21105  
SEPTEMBER 3, 2026**

"THE DESIGN OF THIS PROJECT CONFORMS TO ALL APPLICABLE PROVISIONS OF THE NEW YORK STATE UNIFORM FIRE PREVENTION AND BUILDING CODE, THE NEW YORK STATE ENERGY CONSERVATION CODE, AND THE BUILDING STANDARDS OF THE NEW YORK STATE EDUCATION DEPARTMENT."

"NO NEW ASBESTOS CONTAINING BUILDING MATERIALS (ACBM) SHALL BE USED IN CONSTRUCTION. ASBESTOS REMOVALS WILL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF NYSDOL CODE RULE 56."

THIS PROJECT MANUAL IS ONE PART OF A COHESIVE SET OF CONSTRUCTION DOCUMENTS, INCLUDING SPECIFICATIONS AND DRAWINGS. INTERPRETATION OF THE INFORMATION PRESENTED IS TO BE BASED ON THE ENTIRE SET OF DOCUMENTS.

**YOUNG + WRIGHT ARCHITECTURAL  
50 ELK STREET, SUITE 200  
BUFFALO, NY 14210  
716-842-1800  
WWW.YOUNGANDWRIGHT.COM**

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DOCUMENT 001116 - INVITATION TO BID

1.1 PROJECT INFORMATION

- A. Notice to Bidders: Bidders are invited to submit bids for the Project as described in this Document according to the Instructions to Bidders.
- B. Project Identification: **Lake Shore Central School District Capital Improvement Project 2023 – Phase 3.**
  - 1. Project Locations:  
**Lake Shore High School**  
**959 Beach Road**  
**Angola, NY 14006**  
  
**William G. Houston Middle School**  
**8855 Erie Road**  
**Angola, NY 14006**
- C. Owner:  
**Lake Shore Central School District**  
**959 Beach Road**  
**Angola, NY 14006**
- D. Architect:  
**Young + Wright Architectural**  
**50 Elk Street, Suite 200**  
**Buffalo, NY 14210**  
**716-842-1800**
- E. Construction Manager:  
**Campus Construction Management Group**  
**6225 Sheridan Drive, Suite 100**  
**Williamsville, NY 14221**
- F. Construction Contract: Bids will be received for the following Work:
  - 1. Multiple Contract Project consisting of the following prime contracts:
    - a. Site Construction
    - b. General Building Construction
    - c. Mechanical Construction
    - d. Electrical Construction
    - e. Plumbing Construction

## 1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. **Bid Date: Thursday October 1, 2026**
2. **Bid Time: 1:00 P.M.**
3. **Location:**  
**William T. Hoag Educational Center Annex Building**  
**42 Sunset Boulevard**  
**Angola, NY 14006**

- B. Bids will be thereafter publicly opened and read aloud.

- C. Mail in bids are to be sent to the attention of:

**Kristine DeMartino, District Clerk**  
**Lake Shore Central School District**  
**959 Beach Road**  
**Angola, NY 14006**  
**716-926-2202**

## 1.3 BID SECURITY

- A. Bid bond payable to the owner shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 45 days following the opening of bids. Owner reserves the right to accept or reject any and all bids, to re-advertise for new bids, and to waive informalities and irregularities in connection with any bid.

## 1.4 PREBID CONFERENCE

- A. A prebid conference for all bidders will be held on **Wednesday September 9, 2026 at 2:30pm** starting at the **High School main office front entrance at 959 Beach Road, Angola, NY 14006**. Prospective bidders are requested to attend.

## 1.5 DOCUMENTS

- A. Bid documents are available for examination and review at the following plan rooms:  
Construction Exchange of Western New York  
2660 William Street  
Cheektowaga, New York 14227  
(716) 874-3435  
[melissa@conexbuff.com](mailto:melissa@conexbuff.com)

Dodge Data & Analytics  
<http://construction.com>  
(877) 784-9556  
[Dodge.bidding@construction.com](mailto:Dodge.bidding@construction.com)

Builders Exchange of Rochester  
180 Linden Oaks, Suite 100  
Rochester, NY 14625  
(585) 586-5460  
[projects@robex.com](mailto:projects@robex.com)

Construct Connect  
[content@construction.com](mailto:content@construction.com)

The Builders Exchange of the Southern Tier, Inc. - West  
[planroom@bxstier.com](mailto:planroom@bxstier.com) and [info@bxstier.com](mailto:info@bxstier.com)

Construction Journal  
<https://www.constructionjournal.com/>  
New England: 1-802-658-3797  
Midwest: 1-440-826-4700

- B. Plans and specifications are available to prime contractors by contacting Avalon Document Services at (716) 995-7777 or visiting their online plan room at [www.avalonplanroom.com](http://www.avalonplanroom.com). *Owner can assume no responsibility for errors, omissions or other misinformation via other bid document distribution resources.* A deposit of \$100.00 per set shall be required and shall be made out to **Lake Shore Central School District**. Additional charges will apply for shipping. If you should have any questions, please contact Young + Wright Architectural at (716) 842-1800. Documents will be available by **4:00pm on Friday September 4, 2026**
- C. Bidders or subcontractors who return all Bidding and Contract Documents in good condition within ten (10) days after award of bid and have remitted payment, will receive a full refund of the deposit.

#### 1.6 BIDDER'S QUALIFICATIONS

- A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.
- B. Low bidder will need to provide AIA A305 Contractor's Qualifications prior to post-bid descope interviews.
- C. **All potential bidders must self-perform a minimum of 20% of the work. The Contractor shall provide 20% on site construction or supervision as proof of self-performance associated with the contract that they submit bids for (not including general overhead – i.e. submittals, RFI and RFP paperwork, etc.)**

END OF DOCUMENT 001116

## DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

### 1.1 INSTRUCTIONS TO BIDDERS

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

### 1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

- A. Supplementary Instructions to bidders are included as revisions directly in the standard A701 document. A report of the additions and deletions to the A701 is included at the end of the section for reference only.

### 1.3 EQUIVALENCY CLAUSE – “OR EQUAL” SUBSTITUTES

- A. Where two or more kinds, types, brands, manufacturers, or materials are named in these specifications, they are to be regarded as the required standard of quality and are presumed to be equal. The contractor may select one of these items or, if the contractor desires to use any kind, type, brand, manufacturer or materials other than those named in the specifications, the contractor shall indicate in writing, following the bid opening, when requested, and prior to the award of contract, what kind, type, brand, manufacturer or materials is included in the base bid for the specified item. Following the bid opening, the contractor shall provide all of the requirements of Section 016000 Product Requirements and Substitutions for use by the architect and owners representative in determining that a product or system is indeed equivalent. The owner reserves the right to accept or reject such submissions. Should such materials, products, devices, etc. be rejected, the contractor shall be obligated to conform to the specification requirements or approved equivalent with no charge in price. No substitution will be considered prior to receipt of bids. Bids shall be passed on to any one of the specified products. Bidders shall not use a product contemplated for substitution to establish proposal price. Where only one product is named, such designation has been made in order to match an existing condition exactly to otherwise suit the owner's purpose.
- B. Contractor assumes the risk of an equivalent included in his or her bid being accepted under the process outlined in section 016000. No product will be evaluated as an equivalent prior to the bid opening.

### 1.4 INCONSISTENCIES

- A. In the case of any inconsistency with respect to the quality or quantity of Work required among the Project Manual, Drawings and/or Specifications, or within any of these documents, which are not clarified by addenda, the higher quality standard and/or greater quantity of work must be provided.



## 1.5 RECORD OF BIDDER QUESTIONS

- A. All questions, interpretations, clarifications, etc. pertaining to the bid documents must be made in the separate form provided on the next page and emailed to **Sarah Wilder at swilder@campuscmg.com** and **Tamrah Quadrone at tquadrone@campuscmg.com** with the email subject **Lake Shore CSD Capital Improvement Project 2023 – Phase 3 by 2:00pm on Monday September 21, 2026.** All questions are to reference a drawing number or specification section with page number.
- B. Responses will be in the form of addendum only.

## 1.6 INSURANCE CERTIFICATION

- A. Each bid must be accompanied by an insurance certification provided at the end of this section.

END OF DOCUMENT 00 2113

# **AIA® Document A701® – 2018**

## ***Instructions to Bidders***

for the following Project:

*(Name, location, and detailed description)*

21105 Lake Shore CSD Capital Improvement Project 2023 – Phase3

Lake Shore High School

959 Beach Road

Angola, NY 14006

### **THE OWNER:**

*(Name, legal status, address, and other information)*

Lake Shore Central School District

959 Beach Road

Angola, NY 14006

### **THE ARCHITECT:**

*(Name, legal status, address, and other information)*

Young Architectural, LLC dba Young + Wright Architectural

50 Elk Street, Suite 200

Buffalo, NY 14210

### **THE CONSTRUCTION MANAGER:**

*(Name, legal status, address, and other information)*

Campus Construction Management Group

6225 Sheridan Drive, Suite 100

Williamsville, NY 14221

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### **ADDITIONS AND DELETIONS:**

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

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

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

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



## ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

## ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

## ARTICLE 3 BIDDING DOCUMENTS

### § 3.1 Distribution

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

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

Refer to Section 00 1116 – Invitation to Bid for instructions on obtaining Bidding Documents.

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

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

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

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

### **§ 3.2 Modification or Interpretation of Bidding Documents**

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

**§ 3.2.2** Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)*

Requests for clarification will only be processed and responded to if provided on the attached 'Bidder Question Form' and distributed via email to the parties indicated on the form.

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

**3.2.4** Drawings and reports for Topographic information, sub-surface investigations, ground water information, and similar information are furnished only for the convenience of the Bidders. The Architect and/or Owner make no representation as to the accuracy of such reports and no guarantee as to the conditions that may be encountered during the work.

### **§ 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.

**3.3.1.2** The absence of the 'or equal' clause is not meant to exclude competition in any way. Similar products of any other reputable manufacturers which are equal in quality, as determined by the Architect, and are submitted as specified below and in accordance with specification section 01 6000 – PRODUCT REQUIREMENTS AND SUBSTITUTIONS, will be considered and may be accepted.

### **§ 3.3.2 Substitution Process**

**§ 3.3.2.1** No substitutions will be considered prior to receipt of Bids. Bids shall be based on any one of the specified products. Bidders shall not use a product contemplated for substitution to establish bidder's proposal price. Where only one product is named, such designation has been made in order to match an existing condition exactly or otherwise suit the Owner's purposes.

**§ 3.3.2.2** Substitutions will be considered after the Contract award in accordance with specification section 01 6000 – PRODUCT REQUIREMENTS AND SUBSTITUTIONS. Substitution Requests submitted after the designated submittal period shall not be considered.

#### **§ 3.4 Addenda**

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

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

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

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

### **ARTICLE 4 BIDDING PROCEDURES**

#### **§ 4.1 Preparation of Bids**

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

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

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

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

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

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

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

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

**4.1.9** Bidders shall inform all prospective subcontractors and suppliers from whom they expect to obtain proposals or quotations of the tax-exempt status of the Owner and request that they reflect anticipated tax credits in their proposals or quotations. Following the award by the Owner, Contractors will be provided with the tax-exempt purchase certificates for purchases or transactions as may be applicable under the Contract.

#### **§ 4.2 Bid Security**

**§ 4.2.1** Each Bid shall be accompanied by the following bid security:

*(Insert the form and amount of bid security.)*

Five Percent (5%) of the total Bid, as indicated on the Bid Form and in the Invitation to Bid.



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

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

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

### **§ 4.3 Submission of Bids**

**§ 4.3.1** A Bidder shall submit its Bid as indicated below:

*(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)*

All Bids are to be submitted as paper copies and the Bidder must provide all of the items outlined on the Bid Form with their bid in order to be considered. These items include, but are not limited to the following:

1. Acknowledgement of Allowances (if applicable)
2. Bid Bond
3. Acknowledgement of Site Inspection
4. Acknowledgement of Receipt of Addenda
5. Start of Work Guarantee
6. Immediate Submittals
7. Unit Prices (if applicable)
8. Certificate as to Corporate Bidder (if applicable)
9. Alternate Bids (if applicable)
10. Non-Collusive Affidavit
11. Iran Divestment Act Certification

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

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

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

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

### **§ 4.4 Modification or Withdrawal of Bid**

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

considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

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

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

## **ARTICLE 5 CONSIDERATION OF BIDS**

### **§ 5.1 Opening of Bids**

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders. The Owner reserves the right to postpone the date and time of the opening of the Bids at any time prior to the date and time listed on the Invitation to Bids.

### **§ 5.2 Rejection of Bids**

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

### **§ 5.3 Acceptance of Bid (Award)**

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

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

**5.3.3** All Bids shall remain in force and effect for a period of not less than sixty (60) calendar days following the Award of a Construction Contract.

**5.3.4** When the spread between the low bidder and second low bidder is 10% or more, or when the low bidder has been involved in a prior prevailing wage violation, the low bidder must submit a sworn statement and a detailed cost estimate attesting to the fact that the prevailing wage law will be complied with, including a personal guarantee to make up any under-payments of prevailing wages and an agreement on cases where liability is determined to cover government investigative and enforcement costs and court and enforcement costs incurred by aggrieved worker and entities.

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

### **§ 6.1 Contractor's Qualification Statement**

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

### **§ 6.2 Owner's Financial Capability**

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of



Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

### **§ 6.3 Submittals**

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

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

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

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

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

### **6.4 Start of Work**

**6.4.1** Work at the site shall be started immediately after issuance of written 'Notice to Proceed' and in accordance with the project schedule.

## **ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND**

### **§ 7.1 Bond Requirements**

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

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

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

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

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

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

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

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

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

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

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

- .1 AIA Document A132™–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Advisor Edition, unless otherwise stated below.
- .2 AIA Document A232™–2009, General Conditions of the Contract for Construction,

Construction Manager as Advisor Edition, unless otherwise stated below.

## **Additions and Deletions Report for** **AIA® Document A701® – 2018**

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

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 15:46:58 EDT on 09/02/2026.

### **PAGE 1:**

21105 Lake Shore CSD Capital Improvement Project 2023 – Phase3

Lake Shore High School

959 Beach Road

Angola, NY 14006

-

Lake Shore Central School District

959 Beach Road

Angola, NY 14006

-

Young Architectural, LLC dba Young + Wright Architectural

50 Elk Street, Suite 200

Buffalo, NY 14210

THE CONSTRUCTION MANAGER:

(Name, legal status, address, and other information)

Campus Construction Management Group

6225 Sheridan Drive, Suite 100

Williamsville, NY 14221

### **PAGE 2:**

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

Refer to Section 00 1116 – Invitation to Bid for instructions on obtaining Bidding Documents.

-

### **PAGE 3:**

Requests for clarification will only be processed and responded to if provided on the attached 'Bidder Question Form' and distributed via email to the parties indicated on the form.

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

3.2.4 Drawings and reports for Topographic information, sub-surface investigations, ground water information, and similar information are furnished only for the convenience of the Bidders. The Architect and/or Owner make no representation as to the accuracy of such reports and no guarantee as to the conditions that may be encountered during the work.

3.3.1.2 The absence of the 'or equal' clause is not meant to exclude competition in any way. Similar products of any other reputable manufacturers which are equal in quality, as determined by the Architect, and are submitted as specified below and in accordance with specification section 01 6000 – PRODUCT REQUIREMENTS AND SUBSTITUTIONS, will be considered and may be accepted.

§ 3.3.2.1 Written requests for No substitutions shall be received by the Architect at least ten days considered prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

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

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution based on any one of the specified products. Bidders shall not use a product contemplated for substitution to establish bidder's proposal price. Where only one product is named, such designation has been made in order to match an existing condition exactly or otherwise suit the Owner's purposes.

#### PAGE 4:

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

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

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents. 2.2 Substitutions will be considered after the Contract award in accordance with specification section 01 6000 – PRODUCT REQUIREMENTS AND SUBSTITUTIONS. Substitution Requests submitted after the designated submittal period shall not be considered.

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

4.1.9 Bidders shall inform all prospective subcontractors and suppliers from whom they expect to obtain proposals or quotations of the tax-exempt status of the Owner and request that they reflect anticipated tax credits in their proposals or quotations. Following the award by the Owner, Contractors will be provided with the tax-exempt purchase certificates for purchases or transactions as may be applicable under the Contract.

#### PAGE 5:

Five Percent (5%) of the total Bid, as indicated on the Bid Form and in the Invitation to Bid.

-

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

All Bids are to be submitted as paper copies and the Bidder must provide all of the items outlined on the Bid Form with their bid in order to be considered. These items include, but are not limited to the following:

1. Acknowledgement of Allowances (if applicable)
2. Bid Bond
3. Acknowledgement of Site Inspection
4. Acknowledgement of Receipt of Addenda
5. Start of Work Guarantee
6. Immediate Submittals
7. Unit Prices (if applicable)
8. Certificate as to Corporate Bidder (if applicable)
9. Alternate Bids (if applicable)
10. Non-Collusive Affidavit
11. Iran Divestment Act Certification

-

PAGE 6:

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

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

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders. The Owner reserves the right to postpone the date and time of the opening of the Bids at any time prior to the date and time listed on the Invitation to Bids.

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

5.3.3 All Bids shall remain in force and effect for a period of not less than sixty (60) calendar days following the Award of a Construction Contract.

5.3.4 When the spread between the low bidder and second low bidder is 10% or more, or when the low bidder has been involved in a prior prevailing wage violation, the low bidder must submit a sworn statement and a detailed cost estimate attesting to the fact that the prevailing wage law will be complied with, including a personal guarantee to make up any under-payments of prevailing wages and an agreement on cases where liability is determined to cover government investigative and enforcement costs and court and enforcement costs incurred by aggrieved worker and entities.

PAGE 7:

#### 6.4 Start of Work

6.4.1 Work at the site shall be started immediately after issuance of written 'Notice to Proceed' and in accordance with the project schedule.

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

PAGE 8:

.1 AIA Document A101™–2017A132™–2009, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.

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

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds Construction Manager as Advisor Edition, unless otherwise stated below.

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

.3 .2 AIA Document A201™–2017A232™–2009, General Conditions of the Contract for Construction, unless otherwise stated below.

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

.4 \_\_\_\_\_ Building Information Modeling Exhibit, if completed:

.5 \_\_\_\_\_ Drawings

Number

Title

Date

.6 \_\_\_\_\_ Specifications

Section

Title

Date

Pages

.7 \_\_\_\_\_ Addenda:

Number

Date

Pages

.8 \_\_\_\_\_ Other Exhibits:

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

☐ \_\_\_\_\_ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:

(Insert the date of the E204-2017.)

☐ \_\_\_\_\_ The Sustainability Plan:

Title

Date

Pages

☐ \_\_\_\_\_ Supplementary and other Conditions of the Contract:

Document

Title

Date

Pages

.9 \_\_\_\_\_ Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.) Construction Manager as Advisor Edition, unless otherwise stated below.



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

***AIA® Document D401™ – 2003***

I, Laura Riter, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 15:46:58 EDT on 09/02/2026 under Order No. 20250092981 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ - 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

*(Signed)*

*(Title)*

*(Dated)*





**Silos at Elk Street**  
50 Elk St., Suite 200  
Buffalo, New York 14210

**Buckingham Commons**  
85 Allen St., Suite 310  
Rochester, New York 14608

**DOCUMENT 002113.2 – BIDDER QUESTION FORM**  
**21105.3 - Lake Shore CSD Capital Improvement Project Phase 3**

**BIDDER INFORMATION:**

Company: \_\_\_\_\_

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

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

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

Contract: \_\_\_\_\_

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

**INFORMATION REQUESTED:**

Drawing Reference #: \_\_\_\_\_

Specification Section #: \_\_\_\_\_ Page #: \_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

Email to all the following: **Sarah Wilder - [swilder@campuscmg.com](mailto:swilder@campuscmg.com)**  
**Tamrah Quadrone - [tquadrone@campuscmg.com](mailto:tquadrone@campuscmg.com)**  
**All RFI's are due on Monday September 21, 2026**

## DOCUMENT 003100 – AVAILABLE PROJECT INFORMATION

### 1.1 SECTION INCLUDES:

- A. Lead Survey
- B. Asbestos Survey
- C. Roof Warranty
- D. Tax Exempt Status
- E. List of Drawings
- F. OSHA Notice to Bidders
- G. Worker Notification
- H. Prevailing Wage Rate Schedules

### 1.2 LEAD SURVEYS

- A. A copy of the Survey and Testing for a Lead Coated Surfaces Report is included at the end of this document.
  - 1. Title: Pre-Renovation Inspection
    - a. Prepared by: Stohl Environmental
    - b. Date: 10/9/25
- B. These reports identify the results of the survey, testing and test lab reports of building surfaces having lead-based coatings at the proposed building alterations at Lake Shore High School.
- C. These reports, by their nature, cannot reveal all conditions that exist on the site.
- D. Lead coated surface shall be removed in accordance with “US Department of Housing and Urban Development Guidelines for the Control of Lead hazards in Housing”, dated 1999. Lead abatement work shall comply with applicable OSHA regulations and specify regulation 1962.26. Lead abatement work shall be performed by firms and individuals licensed/certified as Lead Abatement Contractors/Workers by the US EPA. All suspect waste shall be disposed of in an acceptable and legal manner by the abatement contractor.

### 1.3 ASBESTOS SURVEYS

- A. A copy of the Survey and Testing for Asbestos Report is included at the end of this document.
  - 1. Title: Pre-Renovation Inspection
    - a. Prepared by: Stohl Environmental
    - b. Date: 10/9/25
- B. These reports identify the results of the survey, testing and test lab reports for building material containing and having asbestos containing materials at the proposed building alterations at Lake Shore High School.
- C. These reports, by their nature, cannot reveal all conditions that exist on the site.
- D. Asbestos containing material shall be removed in accordance with applicable OSHA regulations. Asbestos Abatement work shall be performed by firms and individuals’

licensed/certified as Asbestos Abatement Contractors/Workers by the US EPA. All suspect asbestos waste shall be disposed of in an acceptable and legal manner by the abatement contractor.

- E. State requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials include, but are not limited to the following:
  - 1. NYSDOL: Industrial Code Rule 56 (Code Rule): Asbestos (as adopted January 11, 2006 and effective September 5, 2006).
  - 2. NYSDEC: Regulations regarding waste collector registration Title 6, Part 364 of the New York State Official compilation of Codes, Rules and Regulations. An annual "Industrial Waste Hauler Permit" specifically for asbestos-containing materials is required for transportation of asbestos-containing waste to the disposal site.
- F. Local Requirements: Abide by all local requirements that govern asbestos abatement work or hauling and disposal of asbestos waste materials.

#### 1.4 ROOF WARRANTY

- A. A copy of the existing Roof Warranty is available at the District.
  - 1. Warranty Provided by: Carlisle
  - 2. Building: High School

#### 1.5 TAX EXEMPT STATUS

- A. The owner is exempt from payment of Federal, State, and local taxes and compensating use taxes of the State of New York, cities and countries. Sales taxes on all materials which will be incorporated into real property are not to be included in bids. This exemption does not apply to supplies, tools, equipment, machinery and materials not incorporated into the project and purchase or leased by the contractor or subcontractors.
- B. Following award of contract, contractors will be provided with exempt purchase certificates.

#### 1.6 LIST OF DRAWINGS

- A. Reference drawing G001 for a complete list of project drawings.

#### 1.7 OSHA NOTICE TO BIDDERS

- A. New legislation – Effective July 18<sup>th</sup> 2008 – OSHA 10 hour Construction Safety and Health Course.

This provision is an addition to existing prevailing wage rate law, Labor Law 220, section 220-h. It requires that on public work projects of at least \$250,000, all laborers, workers and mechanics working on the site, be certified as having successfully completed the OSHA 10-hour construction safety and health course. It further requires that the advertised bids and contracts for every public work contract of at least \$250,000 contain a provision of this requirement.

Note: The OSHA 10 legislation does not apply to projects advertised for bid prior to July 18, 2008 and only applies to workers on public work project that are required under Article 8 to receive the prevailing wage.

#### 1.7 WORKER NOTIFICATION

- A. This provision is in addition to the existing prevailing wage rate law, Labor Law 220, paragraph of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the prevailing wage rate for their particular job classification on each pay stub\*. It also requires contractors and subcontractors to post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone and address for the Department of Labor and a statement informing laborers, workers or mechanics of the right to contact the Department of Labor if he/she is not receiving the proper prevailing wage and/or supplements for his/her particular job downloaded from our website [www.labor.state.ny.us](http://www.labor.state.ny.us) or made available upon request by contacting the Bureau of Public Work at 518-457-5589.

\*In the event that the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

#### 1.8 PREVAILING WAGE RATE SCHEDULES

- A. The contractor is responsible for any wage rate increases for the duration of the project.
- B. A Prevailing Wage Rate Schedule may be obtained from NYS Department of Labor. Please reference the job information and PRC# indicated on the following sheet when inquiring about the project.

#### 1.9 TRADE CONTRACT

- A. AIA document A132-2019 Standard Form of Agreement Between Owner and Contractor, Construction Manager as Advisor Edition, is included in the following pages.

END OF DOCUMENT 003100

# AIA® Document A132® – 2019 Exhibit A

## Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the  day of  in the year **2026**  
(In words, indicate day, month, and year.)

for the following **PROJECT**:

(Name and location or address)

**Lake Shore Central School District  
Capital Improvement Project 2023 – Phase 3**

SED #14-14-01-06-0-001-024

High School  
959 Beach Road, Angola, NY 14006

### THE OWNER:

(Name, legal status, and address)

**Lake Shore Central School District**  
959 Beach Road  
Angola, New York 14006  
Tel: 716-926-2201

### THE CONTRACTOR:

(Name, legal status, and address)

**Contract # -**

## TABLE OF ARTICLES

- A.1 GENERAL**
- A.2 OWNER'S INSURANCE**
- A.3 CONTRACTOR'S INSURANCE AND BONDS**
- A.4 SPECIAL TERMS AND CONDITIONS**

### ADDITIONS AND DELETIONS:

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

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

This document is intended to be used in conjunction with AIA Document A232™–2019, General Conditions of the Contract for Construction. Article 11 of A232™–2019 contains additional insurance provisions

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## ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A232™–2019, General Conditions of the Contract for Construction, as amended.

## ARTICLE A.2 OWNER'S INSURANCE

### § A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3.1. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

### § A.2.2 Liability Insurance

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

### § A.2.3 Required Property Insurance

**§ A.2.3.1** Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds.

**§ A.2.3.1.1 Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake (subject to availability), flood (subject to availability), or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials.

*(Paragraphs deleted)*

**§ A.2.3.1.2 Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to false work and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's, Construction Manager's, and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses.

*(Paragraphs deleted)*

**§ A.2.3.1.3** Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

**§ A.2.3.1.4 Deductibles and Self-Insured Retentions.** If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions. If the Contractor is responsible for the property loss covered by the insurance required by this Section A.2.3, the Contractor shall reimburse the Owner within 30 days of payment of the deductible or self-insured retention by the Owner.

**§ A.2.3.2 Occupancy or Use Prior to Substantial Completion.** The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

### § A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of

the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

#### **§ A.2.4 Optional Extended Property Insurance.**

The Owner shall purchase and maintain the insurance described below.

**§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

*(Paragraph deleted)*

**§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

*(Paragraph deleted)*

**§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

*(Paragraph deleted)*

**§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

*(Paragraph deleted)*

**§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

*(Paragraph deleted)*

**§ A.2.4.6 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

*(Paragraphs deleted)*

### **ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS**

#### **§ A.3.1 General**

**§ A.3.1.1 Certificates of Insurance.** The Contractor shall provide certificates of insurance together with copies of supporting policy forms and endorsements acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate together with copies of supporting policy forms and endorsements evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates and supporting forms will show the Owner as an additional insured on the Contractor's liability policy or policies in accordance with the requirements of Section A.3.1.3. In addition:

- .1 "Certificate Holder" is the Lake Shore Central School District, 959 Beach Rd., Angola, NY 14006.
- .2 Coverages reflected in Certificates of Insurance and underlying policies must comply with all requirements of this Article A.3.
- .3 All insurance documents must be executed with authorized signatures.

- .4 All required liability policies must be endorsed to provide that any Notice of Cancellation or Notice of Non-Renewal given to the First Named Insured shall also be given to the Additional Insureds identified in Article A.3.1.3. A copy of such endorsement(s) must be furnished to the Certificate Holder.
- .5 Failure of the Owner to object to the Contractor's failure to furnish a Certificate or other evidence of the required insurance coverages, object to any defect in such Certificate or other evidence of coverage, or demand receipt of such Certificate or other evidence of coverage is not a waiver of Contractor's obligation to furnish the required insurance coverages. Furthermore, nothing contained in this Article A.3 imposes on the Owner a duty or obligation to review any evidence of insurance coverages or issue any formal approval or acceptance of such evidence, the duty and obligation of the Contractor being to provide insurance meeting the requirements of this Article A.3 regardless of any review or lack of review by the Owner of the Contractor's evidence of insurance. Any acknowledgement of receipt of, or lack of objection by the Owner to, the Contractor's evidence of insurance coverage does not constitute acceptance in any way of any deficiencies in that coverage.
- .6 The Certificate of Insurance must show the coverage form numbers that are used to achieve the coverages required herein.
- .7 The Contractor's liability to and indemnification of the Owner is not relieved or diminished by the Contractor securing insurance coverage in accordance with this Article A.3.
- .8 The Owner reserves the right to modify the requirements herein, including limits, based on circumstances involved, including but not limited to the nature of the risk involved, prior experience, insurer, or coverage.

**§ A.3.1.2 Deductibles and Self-Insured Retentions.** The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

**§ A.3.1.3 Additional Insured Obligations.** To the fullest extent permitted by law, the Contractor shall cause the commercial general liability, automobile liability, umbrella/excess liability, and asbestos abatement liability (if applicable) coverages to include (1) the Owner, the Architect and the Architect's consultants, and the Construction Manager and the Construction Manager'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 for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability, automobile liability, umbrella/excess liability, and asbestos abatement liability (if applicable) insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) form CG 20 10 11 85 or forms CG 2010, CG 20 26, CG 20 33 or CG 20 38 and CG 20 37 together, and, with respect to the Architect and the Architect's consultants, and the Construction Manager and the Construction Manager's consultants, CG 20 32 07 04. The primacy of coverage must be at least as broad as ISO Form CG 20 01 04 13. The additional insured shall be designated as follows:

*"Lake Shore Central School District and its employees, authorized volunteers and committee members, student teachers, auxiliary instructors and members of the Board of Education, and consultants; Young Architectural, LLC dba Young + Wright Architectural and its consultants; and Campus Construction Management (collectively "Additional Insureds")."*

## **§ A.3.2 Contractor's Required Insurance Coverage**

**§ A.3.2.1** The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in New York State or are eligible non-admitted insurers, per the current Excess Line Association of New York's (ELANY) official list. Insurers must carry an A.M. Best "Secure" rating of A- or better. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

*(Paragraph deleted)*

Minimum of three (3) years following Final Completion of the project in accordance with the Contract Documents.

## **§ A.3.2.2 Commercial General Liability**

**§ A.3.2.2.1** Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than one million (\$1,000,000) each occurrence, two million (\$2,000,000) general aggregate, and two million (\$2,000,000) aggregate for products-completed operations hazard, one million (\$1,000,000) for personal and



advertising injury, fifty-thousand (\$50,000) for fire damage (any one fire), and five thousand (\$5,000) for Medical Expense (any one person), all with a per-project aggregate endorsement, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

**§ A.3.2.2.2** The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.
- .12 **Claims involving New York Labor Law, Employer's Liability, third party over actions, or equivalent.**

**§ A.3.2.3 Automobile Liability** covering vehicles registered for use on public highway and used in operations relating to work under the contract that are owned, leased, hired, and non-owned vehicles used, by the Contractor, with a combined single policy limit of not less than **one million (\$1,000,000)** for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage. If any such vehicles are to be used to transport hazardous materials, the Contractor shall also provide pollution liability coverage for autos evidenced by ISO Form CA 99 48, or equivalent, and the Motor Carrier Act Endorsement (MCS90).

*(Paragraph deleted)*

**§ A.3.2.4 Umbrella/Excess Liability** applicable to Commercial General Liability and Automobile Liability coverages per Sections A.3.2.2 and A.3.2.3, with policy limits not less than ten million (\$10,000,000) per occurrence and ten million (\$10,000,000) aggregate.

**§ A.3.2.5 Combination of Coverages.** The Contractor may achieve the required limits and coverage for Commercial General Liability, Automobile Liability, Umbrella/Excess Liability, and Asbestos Abatement/Pollution Liability (if applicable) through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2, A.3.2.3, A.3.2.4, and A.3.3.2.2, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

**§ A.3.2.6 Workers' Compensation and Employers' Liability** coverage for the benefit of the Contractor's employees at statutory limits as required by the New York State Workers' Compensation Law. Evidence of coverage must be provided on the applicable approved form as per the New York State Workers' Compensation Board (i.e. C-105.2, U-26.3, GSI-105.2/SI-12, or CE-200).

§ **A.3.2.7 Disability Benefits** coverage for the benefit of the Contractor's employees as required by the New York State Disability Benefits Law (DBL). Evidence of coverage must be provided on the applicable approved form per the New York State Workers' Compensation Board (i.e. DB-120.1, DB-155, or CE-200).

§ **A.3.2.8 Jones Act**, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ **A.3.2.9 Professional Liability** *(if applicable)*. If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering the Contractor's errors, omissions, and negligent acts arising from the performance of the professional services, with policy limits of not less than two million (\$2,000,000) per claim and two million (\$2,000,000) in the aggregate. If coverage is on a claims-made basis, it must be maintained in force for a minimum of three (3) years following the date of Final Completion of the Project, or, if coverage is cancelled or non-renewed, the Contractor must purchase extended Discovery Clause coverage for a minimum of three (3) years following the date of Final Completion of the Project. Coverage must have a retroactive date no later than the date of the Agreement with the Owner.

§ **A.3.2.10** If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than one million (\$1,000,000) per claim and one million (\$1,000,000) in the aggregate.

§ **A.3.2.11** Coverage under Sections A.3.2.9 and A.3.2.10 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than three million (\$3,000,000) per claim and three million (\$3,000,000) in the aggregate.

§ **A.3.2.12** Insurance for maritime liability risks associated with the operation of a vessel, *if the Work requires such activities*, with policy limits and coverage that are reasonably prudent and acceptable to the Owner in light of the exposures involved.

§ **A.3.2.13 Unmanned Aircraft** *(if applicable)*. Insurance for the use or operation of manned or unmanned aircraft, *if the Work requires such activities*, with policy limits of not less than two hundred fifty thousand (\$250,000) per claim and two hundred fifty thousand (\$250,000) in the aggregate.

§ **A.3.2.14 Cyber Insurance**. The Contractor must have coverage applicable to first- and third-party claims including but not limited to data compromise expenses and liability, forensic review costs, legal review costs, data restoration and re-creation costs, public relations costs, extortion costs, network security liability, identity recovery costs, regulatory fines and penalties, and credit monitoring costs. Limits shall be at least two hundred fifty thousand (\$250,000) per incident and two hundred fifty thousand (\$250,000) in the aggregate.

§ **A.3.2.15 Waiver of Subrogation**. To the fullest extent permitted by applicable state law, a Waiver of Subrogation Clause shall be added to the Contractor's Liability and Workers' Compensation policies in favor of the Owner.

§ **A.3.2.16** If the Contractor carries higher limits or broader coverage than required in this Article A.3, those higher limits and/or broader coverage shall apply. Any available insurance proceeds more than the specified minimum limits of insurance and coverage shall be available to the Owner.

### § **A.3.3 Contractor's Other Insurance Coverage**

§ **A.3.3.1** Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

Minimum of three (3) years following Final Completion of the project in accordance with the Contract Documents.

§ **A.3.3.2** The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

*(Paragraph deleted)*

#### § **A.3.3.2.1**

*(Paragraphs deleted)*

**Railroad Protective Liability Insurance** *(if applicable)*, with policy limits of not less than one million (\$1,000,000)

per claim and **two million (\$2,000,000)** in the aggregate, *if the Work is within fifty (50) feet of railroad property or a railroad right-of-way.*

**§ A.3.3.2.2 Asbestos Abatement Liability Insurance** *(if applicable)*, with policy limits of not less than **ten million (\$10,000,000)** per claim and **ten million (\$10,000,000)** in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials, *if the Work involves such tasks.*

**§ A.3.3.2.3** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

**§ A.3.3.2.4 Other Insurance**

| Coverage                                                                                                                     | Limits                                                                             |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Owner's Protective Liability Policy with XCU exclusion deleted. Named insured shall be "Lake Shore Central School District". | Two million (\$2,000,000) per occurrence and four million (\$4,000,000) aggregate. |

*(Paragraphs deleted)*

**§ A.3.4 Performance Bond and Payment Bond**

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

*(Paragraph deleted)*

| Type             | Penal Sum (\$0.00)   |
|------------------|----------------------|
| Payment Bond     | 100% of Contract Sum |
| Performance Bond | 100% of Contract Sum |

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

**ARTICLE A.4 SPECIAL TERMS AND CONDITIONS**

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

**§ A.4.1 Normal Expiration/Renewal.** When any required insurance is to expire due to the attainment of a normal expiration or renewal date, the Contractor shall supply the Owner, at least ten (10) days prior to either such date, in addition to Certificates of Insurance, with either (1) copies of all renewed insurance policies, including, without limitation, terms, conditions, declarations, riders, and endorsements evidencing continuation of all coverages in the same manner, limits of protection, and scopes of coverage as was provided by the previous policy, or (2) if acceptable to the Owner, all declarations pages, mandatory riders, and/or endorsements that clearly evidence the continuation of all coverages in the same manner, limits of protection, and scope of coverage as was provided by the previous policy.

**§ A.4.2 Subcontractors.** The Contractor shall cause each Subcontractor to (1) procure insurance reasonably satisfactory to the Owner and written by companies licensed to write such insurance in New York State or that are eligible non-admitted insurers meeting the same criteria for the Contractor's insurance companies described in Section A.3.2, and (2) cause the issuers of those insurance policies to name the Additional Insureds as Additional Insureds on a primary and noncontributory basis under each Subcontractor's insurance policies for commercial general, automobile, excess/umbrella liability, and hazardous materials (if applicable to the Subcontractor's portion of the Work). The Additional Insured endorsement included in each such Subcontractor policy must state that coverage is afforded to all Additional Insureds with respect to any and all claims arising out of operations performed by or on behalf of the Contractor. If the Additional Insureds have other insurance applicable to the loss, such other insurance will only apply, if at all, on an excess or contingent basis. The amount of each Subcontractor's insurers' liability is not to be reduced by the existence of such other insurance.

**§ A.4.3 Owner Insurer Loss Payments.** In the event the Owner's insurer(s) make(s) any payment toward any loss covered under any policy of insurance the Contractor is required to procure under this Article A.3, the Owner's insurer(s) are subrogated to all the Contractor's rights of recovery against any person or organization including, but

not limited to, the Contractor's insurer(s), and the Contractor shall execute and deliver all instruments, papers, and whatever else is necessary to secure those rights. The Contractor shall do nothing after the payment of any damages to prejudice those rights.





Kathy Hochul, Governor

Roberta Reardon, Commissioner

LAKE SHORE CSD

ASHLEY JEWETT  
50 Elk Street  
Suite 200  
Buffalo NY 14210

Schedule Year 2025 through 2026  
Date Requested 01/29/2026  
PRC# 2026002100

Location 959 BEACH ROAD  
Project ID#  
Project Type INTERIOR RENOVATIONS, ROADS, STAIRS, MEP UPGRADES

### PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Rate Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2025 through June 2026. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website [www.labor.ny.gov](http://www.labor.ny.gov). Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

#### NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: \_\_\_\_\_ Date Cancelled: \_\_\_\_\_

Name & Title of Representative: \_\_\_\_\_

Phone: (518) 457-5589 Fax: (518) 485-1870  
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

# AIA® Document A132® – 2019

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

**AGREEMENT** made as of the  day of  in the year **2026**  
(In words, indicate day, month, and year.)

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

**Lake Shore Central School District**  
959 Beach Road  
Angola, New York 14006  
Tel: 716-926-2201

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

**Contract # -**

for the portion of the following Project identified as the Contractor's Work in Article 2 of this Agreement:

(Name, location, and detailed description)

**Lake Shore Central School District**  
**Capital Improvement Project 2023 – Phase 3**  
SED #14-14-01-06-0-001-024      High School  
959 Beach Road, Angola, NY 14006

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

**Campus Construction Management Group, Inc.**  
6225 Sheridan Drive, Suite 100  
Williamsville, New York, 14221  
Telephone Number: (716) 239-4884

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

**Young Architectural, LLC dba Young + Wright Architectural**  
50 Elk Street, Suite 200  
Buffalo, New York 14210  
Tel: 716-842-1800

The Owner and Contractor agree as follows.

### **ADDITIONS AND DELETIONS:**

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

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

This document is intended to be used in conjunction with AIA Documents A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser. AIA Document A232™–2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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### EXHIBIT A INSURANCE AND BONDS

### EXHIBIT B BID FORMS AND BID BOND

## ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents comprise of (1) this Agreement between the Owner and Contractor ("Agreement"), (2) Advertisement for Bids, (3) Instructions to Bidders, (4) the General Conditions (AIA Document A232-2019, as amended), (5) Supplementary or other Conditions, if any, (6) Drawings, (7) Specifications, (8) Addenda issued prior to receipt of bids, including any bidding requirements in such Addenda, (9) The Contractor's Bid, (10) Modifications issued after execution of the Agreement, (11) the Contractor's Performance and Payment Bonds, (12) sample forms, (13) other information furnished by the Owner in anticipation of receiving bids, and (14) other documents listed in the Agreement, if any, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. A Modification is (1) a written amendment to the Contract Documents 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. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents.

## 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 DATES OF SUBSTANTIAL COMPLETION

**§ 3.1** The date of commencement of the Work is 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.)*

The date of commencement of the Work shall be:

*(Check one of the following boxes.)*

☒ The date of this Agreement.

☐ A date set forth in a notice to proceed issued by the Owner.

☐

*(Paragraphs deleted)*

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

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

**§ 3.3 Substantial Completion of the Project or Portions Thereof**

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be:

*(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)*

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of all of the Contractors for the Project are to be completed prior to Substantial Completion of the entire Work of all of the Contractors for the Project, the Contractors shall achieve Substantial Completion of such portions by the following dates:

**Portion of Work**

**Substantial Completion Date**

**§ 3.4 When the Work of this Contract, or any Portion Thereof, is Substantially Complete**

§ 3.4.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall substantially complete the entire Work of this Contract:

*(Check one of the following boxes and complete the necessary information.)*

[ ]

[ ] By the following date:

§ 3.4.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work of this Contract are to be substantially complete prior to when the entire Work of this Contract shall be substantially complete, the Contractor shall substantially complete such portions by the following dates:

**Portion of Work**

**Date to be substantially complete**

*(Paragraph deleted)*

**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 one of the following:

*(Check the appropriate box.)*

[ ☒ ] Stipulated Sum, in accordance with Section 4.2 below

*(Paragraph deleted)*

*(Based on the selection above, complete Section 4.2.)*

**§ 4.2 Stipulated Sum**

§ 4.2.1 The Contract Sum shall be \$ ( ), subject to additions and deductions as provided in the Contract Documents.

**§ 4.2.2 Alternates**

§ 4.2.2.1 Alternates, if any, included in the Contract Sum:

**Item**

**Price**



**§ 4.2.2.2** Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.  
*(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)*

| Item | Price | Conditions for Acceptance |
|------|-------|---------------------------|
|      |       |                           |

**§ 4.2.3** Allowances, if any, included in the Contract Sum:  
*(Identify each allowance.)*

| Item | Price |
|------|-------|
|      |       |

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

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

|  |
|--|
|  |
|  |

*(Paragraphs deleted)*  
*(Table deleted)*  
*(Paragraphs deleted)*  
*(Table deleted)*  
*(Paragraphs deleted)*  
*(Table deleted)*  
*(Paragraphs deleted)*  
*(Table deleted)*  
*(Paragraphs deleted)*

## ARTICLE 5 PAYMENTS

### § 5.1 Progress Payments

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

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

|  |
|--|
|  |
|--|

**§ 5.1.3** Provided that an Application for Payment is received by the Construction Manager not later than the 25<sup>th</sup> day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 30<sup>th</sup> day of the following month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Forty-Five ( 45 ) days after the Construction Manager receives the Application for Payment. Additional procedures for Applications for Payment are set forth in Article 9 of the General Conditions.

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

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

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

**§ 5.1.4.2** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment. All progress payments made previous to the last and final payment shall be based on estimates and the right is hereby reserved by the Architect for the Owner to make all due and proper corrections in any payment for any previous error.

**§ 5.1.4.3** In accordance with AIA Document A232™–2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**§ 5.1.4.3.1** The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 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; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

**§ 5.1.4.3.2** The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A232–2019;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232–2019; and
- .5 Retainage withheld pursuant to Section 5.1.7.

*(Paragraphs deleted)*

**§ 5.1.7 Retainage**

**§ 5.1.7.1** For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due: 5%

*(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)*

**§ 5.1.7.1.1** The following items are not subject to retainage: N/A

*(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)*

*(Paragraphs deleted)*

**§ 5.1.7.3** Except as set forth in this Section 5.1.7.3, when the Work of this Contract is substantially complete, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7.

*(Insert any other conditions for release of retainage when the Work of this Contract is substantially complete, or upon Substantial Completion of the Work of all Contractors on the Project or portions thereof.)*

## **§ 5.2 Final Payment**

### **§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum**

**§ 5.2.1.1** 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 Article 12 of AIA Document A232–2019, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect.
- .3 the Contractor has fully performed and complied with the closeout and final payment requirements of the Contract Documents.

**§ 5.2.1.2** The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment, or as follows:

*(Paragraphs deleted)*

**§ 5.2.1.3** In addition to other required items, including but not limited to those required under Section 9.10 of the General Conditions, the final Application for Payment must follow the submission and approval of the following, all in form and substance satisfactory to the Owner and in compliance with applicable law:

1. permanent certificate(s) of occupancy or use issued by the appropriate governmental authority;
2. all maintenance and operating manuals;
3. marked sets of field drawings and specifications reflecting "as-built" conditions;
4. reproducible drawings reflecting the location of any concealed utilities, mechanical and electrical systems, and their components;
5. Assignments of all guarantees and warranties to the Contractor from Subcontractors, materialmen, vendors, or manufacturers, together with a list of their names, addresses, telephone numbers, and corresponding guarantees and warranties from each; and
6. all other information and materials required to comply with the requirements of the Contract documents or reasonable requested by the Owner, Architect, or Construction Management

### **§ 5.2.1.4 Compliance with the New York General Municipal Law**

Notwithstanding Sections 5.1 and 5.2 above, all payments by the Owner to the Contractor will be made in accordance with Section 106-b(1)(a) of the New York General Municipal Law, or any successor statute governing payment by public owners to contractors on public work projects. The provisions of that section supersede, override, and replace anything in this Agreement or elsewhere in the Contract Documents that are or appear to be to the contrary, including but not limited to progress payments, retainage, substantial completion, reduction of retainage, reducing payments as a result of claims, liens, or judgments not suitably discharged, reducing payments for the value of incomplete work following substantial completion, and final completion. In addition, Contractor will make payments to its subcontractors and materialmen in accordance with Section 106-b(2) of the New York General Municipal Law, or any successor statute governing payment by contractors on public work projects to subcontractors and materialmen, which likewise supersede, override, and replace anything in this Agreement or elsewhere in the Contract Documents that are or appear to be to the contrary.

**§ 5.3** Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate New York Statutory Rate applicable to the obligations of Schools Districts.

*(Insert rate of interest agreed upon, if any.)*

%

## **ARTICLE 6 DISPUTE RESOLUTION**

### **§ 6.1 Initial Decision Maker**

The Architect will serve as Initial Decision Maker pursuant to Article 15 of AIA Document A232–2019, 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 Article 15 of AIA Document A232–2019, the method of binding dispute resolution shall be as follows:

*(Check the appropriate box.)*

☐ Arbitration pursuant to Article 15 of AIA Document A232–2019.

☐ Litigation in a court of competent jurisdiction.

☒ Other: *(Specify)*

Litigation in NYS Supreme Court, Erie County

If the Owner and Contractor do not select a method of binding dispute resolution, 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.

## ARTICLE 7 TERMINATION OR SUSPENSION

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

§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232–2019.

*(Paragraphs deleted)*

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232–2019.

*(Paragraphs deleted)*

## ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232–2019 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

*(Name, address, email address, and other information)*

Philip Johnson  
Superintendent of Schools  
959 Beach Road  
Angola, New York 14006  
716-926-2201

§ 8.3 The Contractor's representative:

*(Name, address, email address, and other information)*

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

### § 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance and bonds as set forth in AIA Document A132-2019 Exhibit A – Insurance and Bonds

*(Paragraph deleted)*

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A232-2019, may be given in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

*(If other than in accordance with AIA Document E203-2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)*

*(Paragraphs deleted)*

§ 8.8 Other provisions The Contractor represents and warrants to the Owner (in addition to, and not in lieu of, any other representations and warranties in the Contract Documents or other liability imposed by law with respect to the Contractor's duties, obligations, and performance under this Agreement), to survive execution and delivery of this Agreement, any termination of this Agreement, and final completion of the Work, that:

- .1 it and its Subcontractors are financially solvent, able to pay all debts as they mature, and possess sufficient working capital to complete the Work and perform all obligations under this Agreement;
- .2 it is able to furnish the plant, tools, materials, supplies, equipment, and labor required to complete the Work and perform all obligations under this Agreement;
- .3 it is authorized to do business in the State of New York and is properly licensed by all governmental, public, and quasi-public authorities with jurisdiction over it, the Work, and the Project;
- .4 its execution of and performance under this Agreement are within its duly authorized powers;
- .5 its duly authorized representative visited the site of the Project, became familiar with the local and special conditions under which the Work will be performed, and correlated the observations during such visit(s) with the requirements of the Contract Documents; and
- .6 it possesses the level of experience and expertise in administering, constructing, managing, and superintending projects of the size, complexity, and nature of this Project necessary to perform the Work with proper care, skill, and diligence.

## ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A132™-2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition
- .2 AIA Document A132™-2019, Exhibit A, Insurance and Bonds
- .3 AIA Document A232™-2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition
- .4 Drawings: All Contract Document Drawings
- .5 Specifications: Specification Sections assigned to this Contract as Outlined in the Multiple Contract Summary.

*(Table deleted)*

**.6**  
(Paragraphs deleted)  
Addenda, if any:

| Number | Date | Pages |
|--------|------|-------|
|        |      |       |

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

**.7** Other Exhibits:  
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[  
(Paragraphs deleted)

☒ Exhibit B - Bid Form and Bid Bond

(Table deleted)

**.8** Other documents, if any, listed below:  
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232-2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

## ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in AIA Documents A132-2019 Exhibit A – Insurance and Bonds.

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

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

Philip Johnson, Superintendent of Schools  
(Printed name and title)

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

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

## Pre-Renovation Inspection

Asbestos  
Lead-Based Paint  
Polychlorinated Biphenyls a.k.a. PCB's (in caulk)

of

Lakeshore Central School District – 2021 Capital Improvement – Phase 3  
959 Beach Road  
Angola, New York 14006

Prepared for:



**Lake Shore**  
Central School District

959 Beach Road  
Angola, New York 14006

&



50 Elk Street  
Buffalo, New York 14210

Prepared by:



---

3860 California Road, Orchard Park, New York 14127  
(P) 716-312-0070 (F) 716-312-8092  
[WWW.STOHLENVIRONMENTAL.COM](http://WWW.STOHLENVIRONMENTAL.COM)

Conditions as of October 9, 2025

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## **Section 1.0 Asbestos Inspection**

### **1.1 Introduction**

Stohl Environmental was retained by Young and Wright Architectural to perform supplementary inspection and testing of the building known as Lakeshore High School located at 959 Beach Road in Angola, New York for the presence of suspect materials that are likely to be disturbed during planned renovations and that were not tested as part of the District's AHERA Management Plan.

Stohl Environmental was charged with:

- \* locating suspect asbestos containing materials in client-defined areas,
- \* sampling of these materials to ascertain asbestos content, and
- \* identifying the locations of the confirmed asbestos containing materials.

Although the report is a comprehensive analysis of the asbestos inspection work performed, it would be helpful to review all applicable federal, state and local rules, laws and regulations regarding the handling and treatment of asbestos containing building materials (ACBM). The following is a list of suggested reading and information sources relating to asbestos:

- \* New York State Department of Labor Industrial Code Rule 56
- \* National Emission Standard for Hazardous Air Pollutants (NESHAPS)
- \* Occupational Safety and Health Administration (OSHA 1910.1001, 1910.134, 1910.1020, 1910.1200, 1910.145, 1910.95, 1926.1101)
- \* Environmental Protection Agency rule CFR 763.46 Asbestos Hazard Emergency Response Act

## 1.2 Executive Summary

The asbestos inspection included identification of suspect asbestos containing materials; sampling and analysis of the suspect materials; the development of a plan for the proper handling and/or abatement of confirmed asbestos containing materials; and assistance in preparation of budget estimates for the recommended procedures.

The inspection was conducted on October 8, 2025, and October 9, 2025, and revealed the following materials as suspected of containing asbestos:

**Table 1.2.1 Summary of All Noted Building Materials**

| HAN        | Description                                                     | ACM?                              |
|------------|-----------------------------------------------------------------|-----------------------------------|
| 100A       | Plaster Skim Coat - White - 1952 Building Vintage               | No                                |
| 100B       | Plaster Base Coat - Grey - 1952 Building Vintage                | No                                |
| 101        | Drywall                                                         | No                                |
| 101A       | Joint Compound - White                                          | No                                |
| 102A       | Plaster Skim Coat - White - 1967 Building Vintage               | No                                |
| 102B       | Plaster Base Coat - Grey - 1967 Building Vintage                | No                                |
| 103        | Ceramic Wall Tile - 6" Square - Various Colors                  | Non-Suspect for Asbestos          |
| 103A       | Ceramic Wall Tile - Grout                                       | No                                |
| 103B       | Ceramic Wall Tile - Mastic - White                              | No                                |
| 197        | Glazed Block Wall                                               | Non-Suspect for Asbestos          |
| 198        | Brick                                                           | Non-Suspect for Asbestos          |
| 199        | Block                                                           | Non-Suspect for Asbestos          |
| 200        | 2' x 2' Ceiling Tile - Short Random Fissure                     | No                                |
| 201        | 2' x 2' Ceiling Tile - Fissure                                  | No                                |
| 202        | 2' x 2' Ceiling Tile - Drill Hole - Wood Fiber                  | No                                |
| 202A       | Paper Backing of 2' x 2' Ceiling Tile - Drill Hole - Wood Fiber | No                                |
| 203        | 2' x 2' Ceiling Tile - Smooth Bevel - Cellulose                 | No                                |
| 204        | 2' x 4' Ceiling Tile - Short Random Fissure w/ Dot              | No                                |
| 205A       | Auditorium Ceiling Plaster - Skim Coat - White                  | No                                |
| 205B       | Auditorium Ceiling Plaster - Base Coat - Grey                   | No                                |
| 206        | 2' x 2' Ceiling Tile - Thick Random Fissure                     | No                                |
| 207        | 2' x 4' Ceiling Tile - Sand Pebble Texture                      | No                                |
| 298        | 2' x 2' Ceiling Tile - Smooth Fiberglass Infill                 | Non-Suspect for Asbestos          |
| 299        | Concrete Decking                                                | Non-Suspect for Asbestos          |
| <b>300</b> | <b>9" x 9" Floor Tile</b>                                       | <b>Yes</b>                        |
| 300A       | Black Mastic of 9" x 9" Floor Tile                              | No                                |
| 301        | Vinyl Cove Base                                                 | Non-Suspect for Asbestos          |
| 301A       | Mastic of Vinyl Cove Base                                       | No                                |
| 319        | Terrazzo                                                        | Not Sampled, Not in Scope of Work |
| 320        | Ceramic Floor Tile - 2" x 2"                                    | Non-Suspect for Asbestos          |
| 320A       | Ceramic Floor Tile - Grout                                      | No                                |
| 320B       | Ceramic Floor Tile - Thin Set                                   | No                                |
| 321        | Bathroom Ceramic Floor Tile - 1" x 1"                           | Non-Suspect for Asbestos          |
| 321A       | Bathroom Ceramic Floor Tile - Grout                             | No                                |

**Table 1.2.1 Summary of All Noted Building Materials**

| HAN  | Description                                                        | ACM?                                               |
|------|--------------------------------------------------------------------|----------------------------------------------------|
| 321B | Bathroom Ceramic Floor Tile - Mud Bed                              | No                                                 |
| 322  | Pool Deck Ceramic Floor Tile - 1" x 1"                             | Non-Suspect for Asbestos                           |
| 322A | Pool Deck Ceramic Floor Tile - Grout                               | No                                                 |
| 322B | Pool Deck Ceramic Floor Tile - Mud Bed                             | No                                                 |
| 399  | Concrete                                                           | Non-Suspect for Asbestos                           |
| 400  | End Cap Mastic                                                     | No                                                 |
| 401  | <b>Mechanical Pipe Insulation within Wall Chase</b>                | <b>Yes</b>                                         |
| 402  | Tar Wrap of Coolant Line                                           | No                                                 |
| 403  | Mastic of Fiberglass Pipe Insulation Wrap                          | No                                                 |
| 403A | <b>Mud Fitting of Fiberglass Mechanical Pipe Insulation</b>        | <b>Yes</b>                                         |
| 498  | Roof Drain Insulation - Fiberglass                                 | Non-Suspect for Asbestos                           |
| 499  | Fiberglass Pipe Insulation w/ PVC Fittings                         | Non-Suspect for Asbestos                           |
| 500  | Duct Seam Mastic - Light Grey                                      | No                                                 |
| 600  | <b>Vapor Barrier Tar of Exterior Walls - 1952 Building Vintage</b> | <b>Yes</b>                                         |
| 604  | <b>Vapor Barrier Tar of Exterior Walls - 1967 Building Vintage</b> | <b>Yes</b>                                         |
| 297  | Metal Pan Ceiling                                                  | Non-Suspect for Asbestos                           |
| 605  | <b>Overhead Pool Lighting</b>                                      | <b>Inaccessible for Sampling, Assumed Positive</b> |
| 606  | <b>Pool Balcony Lighting</b>                                       | <b>Inaccessible for Sampling, Assumed Positive</b> |

Sampling and analysis of the suspect materials under Polarized Light Microscopy, and where necessary under Transmission Electron Microscopy, revealed the following materials as asbestos containing building materials (ACBM):

**Table 1.2.2 Summary of Asbestos-Containing Building Materials**

| HAN | Material Description and Approximate Location                                                                                                                                                                                                                                                                                                                                                                                                                                     | Friability / Condition<br>(Note 1) | Approximate Quantity<br>(Note 2)                        |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------|
| 300 | <b>9" x 9" Floor Tile</b> – Located in:<br><ul style="list-style-type: none"> <li>Pool Balcony 125</li> </ul>                                                                                                                                                                                                                                                                                                                                                                     | NF / I                             | 600 Sq Ft                                               |
| 600 | <b>Vapor Barrier Tar of Exterior Walls - 1952 Building Vintage</b> –<br>Located at Exterior Walls in:<br><ul style="list-style-type: none"> <li>Girls Toilet 160</li> <li>Boys Toilet 161</li> <li>Janitor Closet 161C</li> <li>Girls Toilet 174</li> <li>Boys Toilet 175</li> <li>Janitor Closet 188</li> <li>Girls Toilet 243</li> <li>Janitor Closet 245</li> <li>Boys Toilet 244</li> <li>Girls Toilet 250B</li> <li>Boys Toilet 250A</li> <li>Janitor Closet 250C</li> </ul> | NF / I                             | <10 Sq Ft<br>Anticipated to be impacted per Toilet Room |
| 401 | <b>Mechanical Pipe Insulation within Wall Chase</b><br>Located In:<br><ul style="list-style-type: none"> <li>Business 118</li> <li>Accounting 120</li> <li>English 123</li> <li>General Music 142</li> <li>English 106.1</li> <li>English 104.1</li> <li>English 205</li> </ul>                                                                                                                                                                                                   | F / SD                             | No Impact Expected by the Scope of Work                 |

**Table 1.2.2 Summary of Asbestos-Containing Building Materials**

| HAN  | Material Description and Approximate Location                                                                                                                                                                                                                                                                                                                                                         | Friability / Condition<br>(Note 1) | Approximate Quantity<br>(Note 2)         |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------|
| 403A | <b>Mud Fitting of Fiberglass Mechanical Pipe Insulation</b><br>Located In: <ul style="list-style-type: none"> <li>15:1 Special Education 100</li> <li>In School Suspension 101</li> <li>English 102</li> <li>Classroom 105</li> <li>Office 124</li> <li>Business 125</li> <li>History 126</li> <li>Economic Studies 129</li> <li>Studio Art 131</li> <li>3D Art 132A/132B</li> <li>SRO 229</li> </ul> | F / I                              | Limited Impact Expected by Scope of Work |
| 605  | <b>Overhead Pool Lighting</b> – Located in: <ul style="list-style-type: none"> <li>Pool 125</li> </ul>                                                                                                                                                                                                                                                                                                | NF / I                             | 24 Fixtures                              |
| 606  | <b>Pool Balcony Lighting</b> – Located in: <ul style="list-style-type: none"> <li>Pool 125</li> </ul>                                                                                                                                                                                                                                                                                                 | NF / I                             | 6 Fixtures                               |
|      |                                                                                                                                                                                                                                                                                                                                                                                                       |                                    |                                          |

**Notes to Executive Summary**

**Note 1:** Friability/Condition:  
 F=Friable: a material that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure, or is capable of being released into the air by hand pressure.  
 NF=Non Friable: a material that when dry cannot be crumbled, pulverized, or reduced to hand pressure, and is not capable of being released into the air by hand pressure.  
 I=Intact: Asbestos material that has not crumbled, been pulverized, or otherwise been damaged or disturbed, and the material's matrix has not noticeably deteriorated.  
 D=Damaged: Asbestos material that has deteriorated or sustained physical injury demonstrated by separation of the ACM into layers, separation of the ACM from the substrate, flaking, blistering, crumbling, water damage, scrapes, gouges, or other signs of physical injury.  
 SD=Significantly Damaged: Damaged asbestos where the damage is extensive and severe.

**Note 2:** Quantities are approximate, and are only associated with the areas of planned renovation. Additional asbestos containing materials may be located outside areas of planned renovation that were not surveyed, assessed or quantified during this inspection.

### 1.3 Purpose

The purpose of the asbestos inspection was to identify suspect asbestos containing materials in areas of planned renovations that were not sampled or analyzed as part of the District's AHERA Management Plan, as well as materials that in the judgement of the inspector should be re-sampled and analyzed. Samples of the suspect materials were collected for analysis by an independent laboratory. The potential for fiber release was also considered.

The report is generated for the exclusive use of the Lakeshore Central School District and Young and Wright Architectural and is not designed to serve as a specification for abatement. Before requesting bids for abatement of materials identified in this report, the owner is strongly encouraged to contract with a consultant to provide this valuable service. A specification assures that all contractors are bidding on the same methodology and following specific requirements for the work to be performed.

### 1.4 Methodology for Inspection

All work performed by Stohl Environmental was conducted in accordance with applicable regulations including New York State Department of Labor standards 12 NYCRR Part 56, National Emission Standards for Hazardous Air Pollutants (NESHAPS), and Occupational Safety and Health Administration regulations 29 CFR 1910.1101 and 29 CFR 1910.134. All Stohl Environmental personnel assigned to conduct inspections have completed the Environmental Protection Agency (EPA) required training and New York State Department of Labor Division of Safety and Health certification program.

Each suspect asbestos containing building material (ACBM) was assigned a HOMOGENEOUS AREA NUMBER (HAN). Homogeneous areas are materials of like composition, color (in some instances), texture and appearance. As an example, homogeneous area #101 is Drywall.

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## 1.4 Methodology for Inspection (Continued)

Based on the homogeneous areas, samples of suspect materials were collected. Techniques used for sample collection were designed to minimize damage to suspected areas, reduce any potential for fiber release, and ensure the safety of the inspector and building occupants. Samples were collected by Stohl Environmental using the following procedures:

1. The surface to be sampled was sprayed with amended water (detergent and water) as necessary
2. A plastic sample bag was held to the surface sampled
3. The sample was collected using tools appropriate to the friability of the material sampled
4. Sample bags were labeled with a unique sample identification number
5. Samples were recorded on a Chain of Custody form, and submitted under strict chain-of-custody procedures to an ELAP and NYSDOH approved and certified laboratory for analysis

Samples were first analyzed using PLM, Polarized Light Microscopy in accordance with US Environmental Protection Agency Interim Method, 40 CFR Pt 763, Supt F, App A(7-1-87). For the sample results not considered definitive, additional analysis was performed under Transmission Electron Microscopy (TEM) in accordance with NYS DOH ELAP Item #198.4, for Non-friable Organically Bound Bulk Material (NOB). The results of this analysis confirmed whether or not a suspect material actually contained asbestos. The confirmed materials are listed in **SECTION 1.2 Executive Summary**.

## 1.5 Inspection Report

The following table summarizes the results of the inspection work performed at:

**Table 1.5.1 Summary of Asbestos Inspection Results**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| HAN  | Material Description                                            | Sample Number    | Sample Location | PLM Result<br>(Note 1) | TEM Result<br>(Note 2) | ACM?<br>(Yes/No) |
|------|-----------------------------------------------------------------|------------------|-----------------|------------------------|------------------------|------------------|
| 100A | Plaster Skim Coat - White - 1952 Building Vintage               | 1008-LSHS-100A-1 | Boys Toilet 175 | NAD                    | N/A                    | No               |
|      |                                                                 | 1008-LSHS-100A-2 | Boys Toilet 160 | NAD                    | N/A                    | No               |
|      |                                                                 | 1008-LSHS-100A-3 | Boys Toilet 244 | NAD                    | N/A                    | No               |
| 100B | Plaster Base Coat - Grey - 1952 Building Vintage                | 1008-LSHS-100B-1 | Boys Toilet 175 | NAD                    | N/A                    | No               |
|      |                                                                 | 1008-LSHS-100B-2 | Boys Toilet 160 | NAD                    | N/A                    | No               |
|      |                                                                 | 1008-LSHS-100B-3 | Boys Toilet 244 | NAD                    | N/A                    | No               |
| 101  | Drywall                                                         | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 101A | Joint Compound - White                                          | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 102A | Plaster Skim Coat - White - 1967 Building Vintage               | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 102B | Plaster Base Coat - Grey - 1967 Building Vintage                | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 103  | Ceramic Wall Tile - 6" Square - Various Colors                  | Note 6           | Note 6          | N/A                    | N/A                    | No               |
| 103A | Ceramic Wall Tile - Grout                                       | 1008-LSHS-103A-1 | Boys Toilet 160 | NAD                    | N/A                    | No               |
|      |                                                                 | 1008-LSHS-103A-2 | Boys Toilet 160 | NAD                    | N/A                    | No               |
| 103B | Ceramic Wall Tile - Mastic - White                              | 1008-LSHS-103B-1 | Boys Toilet 160 | NAD                    | NAD                    | No               |
|      |                                                                 | 1008-LSHS-103B-2 | Boys Toilet 160 | NAD                    | NAD                    | No               |
| 197  | Glazed Block Wall                                               | Note 6           | Note 6          | N/A                    | N/A                    | No               |
| 198  | Brick                                                           | Note 6           | Note 6          | N/A                    | N/A                    | No               |
| 199  | Block                                                           | Note 6           | Note 6          | N/A                    | N/A                    | No               |
| 200  | 2' x 2' Ceiling Tile - Short Random Fissure                     | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 201  | 2' x 2' Ceiling Tile - Fissure                                  | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 202  | 2' x 2' Ceiling Tile - Drill Hole - Wood Fiber                  | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |
| 202A | Paper Backing of 2' x 2' Ceiling Tile - Drill Hole - Wood Fiber | Note 3           | Note 3          | N/A                    | N/A                    | No - See Note 3  |

**Table 1.5.1 Summary of Asbestos Inspection Results**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| HAN  | Material Description                               | Sample Number    | Sample Location   | PLM Result<br>(Note 1) | TEM Result<br>(Note 2) | ACM?<br>(Yes/No)  |
|------|----------------------------------------------------|------------------|-------------------|------------------------|------------------------|-------------------|
| 203  | 2' x 2' Ceiling Tile - Smooth Bevel - Cellulose    | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 204  | 2' x 4' Ceiling Tile - Short Random Fissure w/ Dot | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 205A | Auditorium Ceiling Plaster - Skim Coat - White     | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 205B | Auditorium Ceiling Plaster - Base Coat - Grey      | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 206  | 2' x 2' Ceiling Tile - Thick Random Fissure        | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 207  | 2' x 4' Ceiling Tile - Sand Pebble Texture         | 1008-LSHS-207-1  | Girls Toilet 175  | NAD                    | NAD                    | No                |
|      |                                                    | 1008-LSHS-207-2  | Girls Toilet 254  | NAD                    | NAD                    | No                |
| 297  | Metal Pan Ceiling                                  | Note 6           | Note 6            | N/A                    | N/A                    | No                |
| 298  | 2' x 2' Ceiling Tile - Smooth Fiberglass Infill    | Note 6           | Note 6            | N/A                    | N/A                    | No                |
| 299  | Concrete Decking                                   | Note 6           | Note 6            | N/A                    | N/A                    | No                |
| 300  | 9" x 9" Floor Tile                                 | Note 4           | Note 4            | N/A                    | N/A                    | Yes - See Note 4. |
| 300A | Black Mastic of 9" x 9" Floor Tile                 | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 301  | Vinyl Cove Base                                    | Note 3           | Note 3            | N/A                    | N/A                    | No                |
| 301A | Mastic of Vinyl Cove Base                          | Note 3           | Note 3            | N/A                    | N/A                    | No - See Note 3   |
| 319  | Terrazzo                                           | Note 4           | Note 4            | N/A                    | N/A                    | Note 4            |
| 320  | Ceramic Floor Tile - 2" x 2"                       | Note 6           | Note 6            | N/A                    | N/A                    | No                |
| 320A | Ceramic Floor Tile - Grout                         | 1008-LSHS-320A-1 | Girls Toilet 250B | NAD                    | N/A                    | No                |
|      |                                                    | 1008-LSHS-320A-2 | Girls Toilet 254  | NAD                    | N/A                    | No                |
| 320B | Ceramic Floor Tile - Thin Set                      | 1008-LSHS-320B-1 | Girls Toilet 250B | NAD                    | N/A                    | No                |
|      |                                                    | 1008-LSHS-320B-2 | Girls Toilet 254  | NAD                    | N/A                    | No                |
| 321  | Bathroom Ceramic Floor Tile - 1" x 1"              | Note 6           | Note 6            | N/A                    | N/A                    | No                |
| 321A | Bathroom Ceramic Floor Tile - Grout                | 1008-LSHS-321A-1 | Girls Toilet 254  | NAD                    | N/A                    | No                |
|      |                                                    | 1008-LSHS-321A-2 | Girls Toilet 254  | NAD                    | N/A                    | No                |
| 321B | Bathroom Ceramic Floor Tile - Mud Bed              | 1008-LSHS-321B-1 | Girls Toilet 254  | NAD                    | N/A                    | No                |
|      |                                                    | 1008-LSHS-321B-2 | Girls Toilet 254  | NAD                    | N/A                    | No                |



**Table 1.5.1 Summary of Asbestos Inspection Results**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| HAN  | Material Description                                        | Sample Number    | Sample Location                           | PLM Result<br>(Note 1) | TEM Result<br>(Note 2) | ACM?<br>(Yes/No)  |
|------|-------------------------------------------------------------|------------------|-------------------------------------------|------------------------|------------------------|-------------------|
| 322  | Pool Deck Ceramic Floor Tile - 1" x 1"                      | Note 6           | Note 6                                    | N/A                    | N/A                    | No                |
| 322A | Pool Deck Ceramic Floor Tile - Grout                        | 1008-LSHS-322A-1 | Pool 125                                  | NAD                    | N/A                    | No                |
|      |                                                             | 1008-LSHS-322A-2 | Pool 125                                  | NAD                    | N/A                    | No                |
| 322B | Pool Deck Ceramic Floor Tile - Mud Bed                      | 1008-LSHS-322B-1 | Pool 125                                  | NAD                    | N/A                    | No                |
|      |                                                             | 1008-LSHS-322B-2 | Pool 125                                  | NAD                    | N/A                    | No                |
| 399  | Concrete                                                    | Note 6           | Note 6                                    | N/A                    | N/A                    | No                |
| 400  | End Cap Mastic                                              | Note 3           | Note 3                                    | N/A                    | N/A                    | No - See Note 3   |
| 401  | Mechanical Pipe Insulation within Wall Chase                | Note 4           | Note 4                                    | N/A                    | N/A                    | Yes - See Note 4. |
| 402  | Tar Wrap of Coolant Line                                    | Note 3           | Note 3                                    | N/A                    | N/A                    | No - See Note 3   |
| 403  | Mastic of Fiberglass Pipe Insulation Wrap                   | Note 3           | Note 3                                    | N/A                    | N/A                    | No - See Note 3   |
| 403A | Mud Fitting of Fiberglass Mechanical Pipe Insulation        | Note 4           | Note 4                                    | N/A                    | N/A                    | Yes - See Note 4. |
| 498  | Roof Drain Insulation - Fiberglass                          | Note 6           | Note 6                                    | N/A                    | N/A                    | No                |
| 499  | Fiberglass Pipe Insulation w/ PVC Fittings                  | Note 6           | Note 6                                    | N/A                    | N/A                    | No                |
| 500  | Duct Seam Mastic - Light Grey                               | 1008-LSHS-500-1  | Boys Toilet 244                           | NAD                    | NAD                    | No                |
|      |                                                             | 1008-LSHS-500-2  | 2nd Floor Corridor Outside Vestibule 263A | NAD                    | NAD                    | No                |
| 600  | Vapor Barrier Tar of Exterior Walls - 1952 Building Vintage | Note 4           | Note 4                                    | N/A                    | N/A                    | Yes - See Note 4. |
| 604  | Vapor Barrier Tar of Exterior Walls - 1967 Building Vintage | Note 4           | Note 4                                    | N/A                    | N/A                    | Yes - See Note 4. |
| 605  | Overhead Pool Lighting                                      | Note 5           | Note 5                                    | N/A                    | N/A                    | Yes Note 5        |
| 606  | Pool Balcony Lighting                                       | Note 5           | Note 5                                    | N/A                    | N/A                    | Yes Note 5        |

SEE NOTES FOR TABLE 1.5 ON FOLLOWING PAGE

**Notes to Inspection Table 1.5:**

- Note 1:** PLM= Analysis by Polarized Light Microscopy  
**Note 2:** TEM = Transmission Electron Microscopy. NYSDOH requires Non-friable Organically Bound (NOB) bulk materials be additionally analyzed by TEM if negative under PLM.  
**Note 3:** Material was previously sampled and analyzed as negative for asbestos as part of the school's AHERA inspection or Previous Pre-Renovation Inspections, re-sampling is not necessary or cost effective for the client.  
**Note 4:** Material was previously sampled and analyzed as positive for asbestos as part of the school's AHERA inspection or Previous Pre-Renovation Inspections, re-sampling is not necessary or cost effective for the client.  
**Note 5:** Inaccessible for Sampling, Assumed Positive  
**Note 6:** Non Suspect Material, Not Sampled
- NAD** = No Asbestos Detected  
**N/A** = Not applicable  
**NA/PS** = Not Analyzed / Positive Stop  
**Trace** = Less than 1% asbestos, material considered non-ACM  
**Chr** = Chrysotile Asbestos

## **Section 2.0 Lead-Based Paint Inspection**

### **2.1 Introduction**

Stohl Environmental was retained by Young and Wright Architectural to inspect the building known as Lakeshore High School, located at 959 Beach Road in Angola, New York for the presence of surfaces covered with lead-based paint (LBP) or a lead-based coating in areas of planned renovations.

Stohl Environmental was charged with:

1. locating suspect surfaces within the renovation areas and damaged paint throughout the building,
2. measuring lead concentrations on suspect surfaces using an X-ray florescence spectrum analyzer, and
3. bulk sampling for lab analysis where necessary.

Although this report is a comprehensive analysis of the lead-based paint in this structure, the following information, as well as a reading of the sources listed at the end of this section, will help ensure compliance to applicable rules, laws and regulations regarding lead based paint.

### **Amendment to Regulations of the Commissioner of Education (1999)**

According to this document, “Any construction or maintenance operations which will disturb lead- based paint will require abatement of those areas pursuant to the protocols detailed in the *“Guidelines for the Evaluation and Control of Lead-based Paint...”* All areas scheduled for construction as well as areas of flaking and peeling paint shall be tested for the presence of lead and abated or encapsulated.”

## 2.1 Introduction (Continued)

### TITLE X:

On October 28, 1995, the Housing and Community Development Act of 1992 was signed into law. Title X, as this bill is commonly referred to, is comprehensive and significant in addressing lead poisoning and prevention. Under the Toxic Substances Control Act (TSCA), as amended by Title X, EPA is developing regulations governing lead-based paint hazard evaluation and abatement in private and public housing, public and commercial buildings and commercial structures. When the changes brought about by this legislation are fully defined and enacted, virtually all parties involved in ownership, rental, management, financing/lending, contracting/abatement, and insurance will be affected.

Although it is recommended that property owners, lenders, insurers, etc. become familiar with the full content of Title X and the EPA regulations, an understanding of the following terms will assist in the interpretation of the results of this survey:

1. The term "lead-based paint" as used in Title X is defined as paint on surfaces with lead equal to or in excess of 1.0 mg/cm<sup>2</sup> (milligrams per centimeter squared) as measured by X-ray fluorescence (XRF) detector or 0.5 percent by weight.
2. The term "lead based paint hazard" is defined as any condition that causes exposure to lead sufficient to cause adverse human effects.
3. "Deteriorated LBP" is any interior or exterior LBP that is peeling, chipping, chalking, or cracking, or located on a surface or fixture that is damaged or deteriorated.
4. LBP on any "friction surface" is defined as any interior or exterior surface subject to damage by repeated impacts, such as painted floors and friction surfaces on windows.
5. LBP on any "impact surface" is defined as any interior or exterior surface subject to damage by repeated impacts, such as parts of door frames.
6. LBP on any "accessible surface" is defined as any interior or exterior surface accessible for a young child to mouth or chew, such as a window sill.
7. "Lead-contaminated dust" is defined as a surface dust in residential dwellings that contains an area or mass concentration of lead in excess of the standard to be established by EPA.

## 2.1 Introduction (Continued)

### OSHA

On May 4, 1993, OSHA promulgated the Lead Exposure in Construction Rule (29 CFR Part 1926.62). This regulation applies to all construction activities involving potential lead exposures. This regulation defines construction work as "...work for construction, alteration and/or repair including painting and decorating" and further states "...the standard for the construction industry applies to all occupational exposure to lead in all construction work in which lead, in any amount, is present in an occupationally related context ... where the source of the lead is employment related..."

The employer must ensure that no worker is exposed to concentrations of lead in excess of the permissible exposure limit (PEL) for lead, which is an eight hour time weighted average (TWA) exposure of 50 mg/m<sup>3</sup> (micrograms per cubic meter). This means that the pre-project site must be inspected to determine if a lead hazard exists. If determined to exist, the employer must either perform an "Exposure Assessment" as defined in 29 CFR Part 1926.62 paragraph (d), or implement employee protective measures as prescribed in paragraph (d)(2)(v) including appropriate respiratory protection, personal protective clothing, change areas, hand washing facilities, biological monitoring, and training.

### HUD

The statutory requirements and foundations for HUD Guidelines can be found in Section 302 of the Lead-Based Paint Poisoning Prevention Act (LBPPPA).

Certain aspects of the HUD Guidelines are typically applied to public and commercial buildings. The most common adopted techniques used to identify LBP are X-ray Fluorescence Spectrum Analyzer (XRF) and Atomic Absorption Spectroscopy (AAS). HUD defines LBP as having an XRF reading greater than 1.0 mg of lead per centimeter squared, or a paint chip analyzed by AAS having greater than 0.5 percent lead by weight.

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## 2.2 Methodology

Stohl Environmental used a Viken Spectrum Analyzer to test suspect painted surfaces on the interior areas in areas of planned renovations and any damaged paint throughout the facility. Each component tested is identified by its particular side of the building, labeled walls "A, B, C, or D". Side A of any room is always the same side as the front exterior entrance (or address side of the building). Side B is the side to the left of side A, and so on.

Representative surfaces/components were tested in a manner designed to adequately represent the different components, substrates, types of paint, construction and paint history throughout the building. Surfaces tested included interior walls, doors, windows, radiators and other painted components.

## 2.3 Inspection Report

During the lead-based paint inspection conducted on October 8, 2025 the interior painted components in areas of planned renovations and any damaged paint were inspected and tested throughout the facility. Painted components were identified and tested based on component groups and paint history.

The XRF analysis indicated that the following painted surfaces have a lead content at greater than the Title X threshold (greater than 1.0 mg/cm<sup>2</sup>) for classification as lead-based paint. For any renovations undertaken that require demolition of these painted surfaces, contractors should be advised of the presence of lead, and required to comply with the aforementioned OSHA regulations for construction worker safety.

Component groups that were identified to contain LBP are:

### 1952 Vintage – Original Building

- Structural Steel, I-Beams, and Cross Beams of the 1952 Building Vintage
- Green Glazed Block
- Tan Glazed Block

### 1967 Vintage - Addition

- Blue Glazed Block in the Pool Area

(SEE THE TABLE IN SECTION 2.4 FOR XRF ANALYSIS OF INDIVIDUAL COMPONENTS/SUBSTRATES)

**Table 2.4 XRF Spectrum Analyzer Report**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| Reading No | Side        | Room         | Component   | Substrate                   | Color  | Results  | XRF Reading |
|------------|-------------|--------------|-------------|-----------------------------|--------|----------|-------------|
| 1          | Calibration |              |             |                             |        |          | 1.1         |
| 2          | Calibration |              |             |                             |        |          | 1           |
| 3          | Calibration |              |             |                             |        |          | 1.1         |
| 4          | Calibration |              |             |                             |        |          | 1.1         |
| 5          | A           | Room 179     | Wall        | Ceramic Tile                | Yellow | Negative | 0           |
| 6          | C           | Room 179     | Wall        | Ceramic Tile                | Yellow | Negative | 0           |
| 7          | C           | Room 179     | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 8          | C           | Room 179     | Door Casing | Metal                       | Brown  | Negative | 0.4         |
| 9          | C           | Room 179     | Door        | Wood                        | Brown  | Negative | 0.1         |
| 10         | -           | Room 179     | I-Beam      | Metal                       | Brown  | Negative | 0.1         |
| 11         | -           | Room 179C    | Wall        | Ceramic Tile                | Beige  | Negative | 0.1         |
| 12         | B           | Room 179C    | Wall        | Ceramic Tile                | Beige  | Negative | 0           |
| 13         | B           | Room 179A    | Wall        | Ceramic Tile                | Beige  | Negative | 0           |
| 14         | D           | Room 179A    | Wall        | Ceramic Tile                | Beige  | Negative | 0           |
| 15         | -           | Room 179A    | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 16         | D           | Room 179A    | Wall        | Ceramic Tile                | Beige  | Negative | 0           |
| 17         | D           | Room 179A    | Door        | Wood                        | Brown  | Negative | 0.1         |
| 18         | D           | Room 179A    | Door Casing | Metal                       | White  | Negative | 0           |
| 19         | D           | Corridor 178 | Wall        | Glazed Block                | Green  | Positive | 3.1         |
| 20         | D           | Corridor 178 | Wall        | Plaster                     | White  | Negative | 0           |
| 21         | C           | Corridor 176 | Wall        | Plaster                     | White  | Negative | 0.2         |
| 22         | C           | Corridor 176 | Wall        | Glazed Block                | Green  | Positive | 2.2         |
| 23         | A           | Room 175     | Wall        | Ceramic Tile                | Green  | Negative | 0.2         |
| 24         | C           | Room 175     | Wall        | Ceramic Tile                | Green  | Negative | 0.2         |
| 25         | -           | Room 175     | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 26         | A           | Room 175     | Door        | Wood                        | Orange | Negative | 0           |
| 27         | A           | Room 175     | Door Casing | Metal                       | White  | Negative | 0.5         |



**Table 2.4 XRF Spectrum Analyzer Report**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| Reading No | Side        | Room             | Component   | Substrate                   | Color        | Results         | XRF Reading |
|------------|-------------|------------------|-------------|-----------------------------|--------------|-----------------|-------------|
| 28         | A           | Room 175         | Door Casing | Ceramic Tile                | Gray         | Negative        | 0.4         |
| 29         | C           | Room 175         | Door Casing | Ceramic Tile                | Gray         | Negative        | 0.2         |
| <b>30</b>  | <b>C</b>    | <b>Room 175B</b> | <b>Wall</b> | <b>Glazed Block</b>         | <b>Gray</b>  | <b>Positive</b> | <b>1.8</b>  |
| 31         | C           | Room 174         | Wall        | Ceramic Tile                | Yellow       | Negative        | 0           |
| 32         | B           | Room 174         | Wall        | Ceramic Tile                | Yellow       | Negative        | 0.4         |
| 33         | -           | Room 174         | Wall        | Toilet Room Stall Partition | Black        | Negative        | 0.2         |
| 34         | A           | Room 174         | Door        | Wood                        | Yellow       | Negative        | 0           |
| 35         | A           | Room 174         | Door Casing | Metal                       | Gray         | Negative        | 0.2         |
| 36         | Calibration |                  |             |                             |              |                 | 1           |
| 37         | Calibration |                  |             |                             |              |                 | 0           |
| 38         | Calibration |                  |             |                             |              |                 | 0           |
| 39         | D           | Room 161         | Door        | Wood                        | Brown        | Negative        | 0           |
| 40         | D           | Room 161         | Door Casing | Metal                       | Brown        | Negative        | 0.4         |
| 41         | C           | Room 161         | Wall        | Ceramic Tile                | Brown        | Negative        | 0.3         |
| 42         | A           | Room 161         | Wall        | Ceramic Tile                | Brown        | Negative        | 0           |
| 43         | -           | Room 161         | Wall        | Toilet Room Stall Partition | Black        | Negative        | 0           |
| <b>44</b>  | <b>-</b>    | <b>Room 160B</b> | <b>Wall</b> | <b>Glazed Block</b>         | <b>Brown</b> | <b>Positive</b> | <b>2.9</b>  |
| 45         | D           | Room 160         | Wall        | Ceramic Tile                | Brown        | Negative        | 0.3         |
| 46         | A           | Room 160         | Wall        | Ceramic Tile                | Brown        | Negative        | 0.2         |
| 47         | -           | Room 160         | Wall        | Toilet Room Stall Partition | Black        | Negative        | 0           |
| 48         | -           | Room 160         | Door        | Wood                        | Brown        | Negative        | 0.1         |
| 49         | -           | Room 160         | Door Casing | Metal                       | Brown        | Negative        | 0.3         |
| 50         | D           | 243              | Door Casing | Metal                       | Cyan         | Negative        | 0           |
| 51         | A           | 243              | Wall        | Ceramic Tile                | Yellow       | Negative        | 0.3         |
| 52         | C           | 243              | Wall        | Ceramic Tile                | Yellow       | Negative        | 0           |
| 53         | -           | 243              | Wall        | Toilet Room Stall Partition | Black        | Negative        | 0           |
| 54         | -           | 244              | Wall        | Toilet Room Stall Partition | Black        | Negative        | 0           |

**Table 2.4 XRF Spectrum Analyzer Report**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| Reading No | Side | Room                    | Component   | Substrate                   | Color  | Results  | XRF Reading |
|------------|------|-------------------------|-------------|-----------------------------|--------|----------|-------------|
| 55         | B    | 244                     | Wall        | Ceramic Tile                | Gray   | Negative | 0.4         |
| 56         | D    | 244                     | Wall        | Ceramic Tile                | Gray   | Negative | 0.2         |
| 57         | D    | 2nd Floor 1952 Corridor | Wall        | Plaster                     | Gray   | Negative | 0           |
| 58         | D    | 2nd Floor 1952 Corridor | Wall        | Plaster                     | Gray   | Negative | 0           |
| 59         | -    | 250A                    | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 60         | B    | 250A                    | Wall        | Ceramic Tile                | Gray   | Negative | 0.3         |
| 61         | D    | 250A                    | Wall        | Ceramic Tile                | Gray   | Negative | 0.2         |
| 62         | D    | 250A                    | Door        | Wood                        | Orange | Negative | 0           |
| 63         | D    | 250A                    | Door Casing | Metal                       | Tan    | Negative | 0.3         |
| 64         | D    | 250B                    | Door Casing | Metal                       | Tan    | Negative | 0           |
| 65         | B    | 250B                    | Door        | Wood                        | Tan    | Negative | 0           |
| 66         | -    | 250B                    | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 67         | C    | 250B                    | Wall        | Ceramic Tile                | Yellow | Negative | 0           |
| 68         | A    | 250B                    | Wall        | Ceramic Tile                | Yellow | Negative | 0.1         |
| 69         | A    | 254                     | Wall        | Ceramic Tile                | Gray   | Negative | 0           |
| 70         | C    | 254                     | Wall        | Ceramic Tile                | Gray   | Negative | 0           |
| 71         | -    | 254                     | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 72         | -    | 254                     | Door        | Wood                        | Orange | Negative | 0           |
| 73         | -    | 254                     | Door Casing | Wood                        | White  | Negative | 0.5         |
| 74         | -    | 255                     | Door Casing | Wood                        | White  | Negative | 0.5         |
| 75         | -    | 255                     | Door        | Wood                        | White  | Negative | 0           |
| 76         | -    | 255                     | Wall        | Toilet Room Stall Partition | Black  | Negative | 0           |
| 77         | B    | 255                     | Wall        | Ceramic Tile                | Blue   | Negative | 0           |
| 78         | D    | 255                     | Wall        | Ceramic Tile                | Blue   | Negative | 0           |
| 79         | D    | 125                     | Stair Tread | Concrete                    | Blue   | Negative | 0           |
| 80         | D    | 125                     | Stair Riser | Concrete                    | Blue   | Negative | 0           |

**Table 2.4 XRF Spectrum Analyzer Report**

**Lakeshore High School – 959 Beach Road, Angola, NY 14006**

| Reading No | Side        | Room       | Component   | Substrate           | Color       | Results         | XRF Reading |
|------------|-------------|------------|-------------|---------------------|-------------|-----------------|-------------|
| 81         | D           | 125        | Floor       | Concrete            | Blue        | Negative        | 0           |
| 82         | D           | 125        | Trim        | Metal               | Blue        | Negative        | 0.5         |
| 83         | D           | 125        | Bracket     | Metal               | Blue        | Negative        | 0.4         |
| 84         | D           | 125        | Bench       | Wood                | Brown       | Negative        | 0           |
| 85         | D           | 125        | Wall        | Block               | Blue        | Negative        | 0           |
| <b>86</b>  | <b>A</b>    | <b>125</b> | <b>Wall</b> | <b>Glazed Block</b> | <b>Blue</b> | <b>Positive</b> | <b>2</b>    |
| <b>87</b>  | <b>C</b>    | <b>125</b> | <b>Wall</b> | <b>Glazed Block</b> | <b>Blue</b> | <b>Positive</b> | <b>1.5</b>  |
| 88         | C           | 125        | Door        | Metal               | Blue        | Negative        | 0           |
| 89         | C           | 125        | Wall        | Block               | Blue        | Negative        | 0           |
| <b>90</b>  | <b>C</b>    | <b>125</b> | <b>Wall</b> | <b>Glazed Block</b> | <b>Blue</b> | <b>Positive</b> | <b>1.1</b>  |
| 91         | Calibration |            |             |                     |             |                 | 1.1         |
| 92         | Calibration |            |             |                     |             |                 | 1.1         |

## **Section 3.0 PCBs in Caulk Sampling**

### **3.1 Introduction**

Stohl Environmental was retained by Young and Wright Architectural to inspect Lakeshore High School located at 959 Beach Road, in Angola, New York, for the presence of caulking/sealant materials suspected of containing Polychlorinated Biphenyls (PCBs) that may be impacted by planned renovations.

Stohl Environmental was charged with:

1. locating suspect materials,
2. bulk sampling of caulking/sealants for lab analysis to determine PCB content.
3. submission of samples to an independent certified laboratory, and preparation of a summary report

### **3.2 Background**

PCBs are mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties ranging from oily liquids to waxy solids. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics, rubber and caulking products; in pigments, dyes and carbonless copy paper and many other applications. More than 1.5 billion pounds of PCBs were manufactured in the United States prior to cessation of production in 1977.

Concern over the toxicity and persistence in the environment of Polychlorinated Biphenyls (PCBs) led Congress in 1976 to enact 6(e) of the Toxic Substances Control Act (TSCA) that included among other things, prohibitions on the manufacture, processing, and distribution in commerce of PCBs.

The following is a partial listing of applicable regulations regarding proper handling and disposal:

- \* New York State Department of Environmental Conservation - 6 NYCRR Part 371
- \* USEPA 40 CFR Part 761.62 Disposal of PCB Bulk Product Waste

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### **3.3 Methodology**

Stohl Environmental collected samples of at least 10g of Caulk/Sealant. Samples were recorded and handled according to strict chain-of-custody protocol sample sizes and submitted to an independent certified laboratory for analysis by EPA Method 8082.

All solid wastes containing 50 parts per million (ppm) by weight (on a dry weight basis for other than liquid wastes) or greater of polychlorinated biphenyls (PCBs) are listed hazardous wastes, excluding small capacitors as defined in paragraph (3) of NYCRR Part 371 and PCB Articles drained in accordance with subparagraphs (2)(ii) and (iii) of Part 371 Section (e). PCB Articles that contain less than 50 ppm PCBs are not regulated as hazardous waste.

### **3.4 Inspection Report**

During the PCB Caulk sampling conducted on there were no materials within the scope of work identified to be suspect for containing PCBs or PCB contamination. Therefore, no samples were taken during this inspection.



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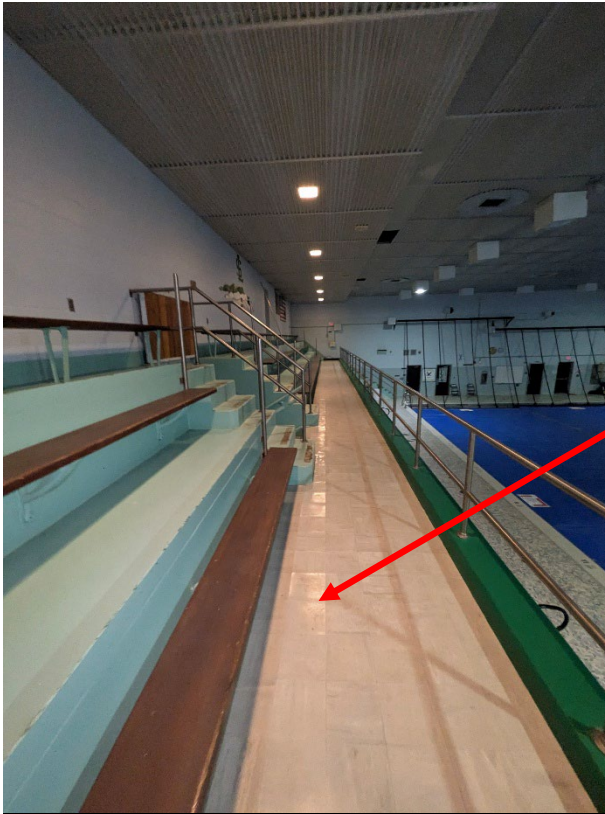
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7451 South Lake Road  
Bergen, New York 14416  
585-252-0070

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## Appendix A    ACM Site Photos

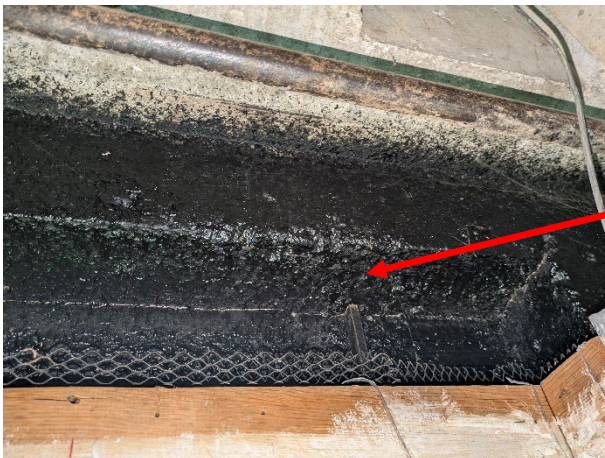
## Appendix A    ACM Site Photos



**Asbestos Material In Photo**

**HAN 300 9" x 9" Floor Tile**

**See Section 1.2 for approximate quantities and location(s) of asbestos containing material(s)**



**Asbestos Material In Photo**

**HAN 600 Vapor Barrier Tar of Exterior Walls**

**See Section 1.2 for approximate quantities and location(s) of asbestos containing material(s)**



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## Appendix B LBP Site Photos



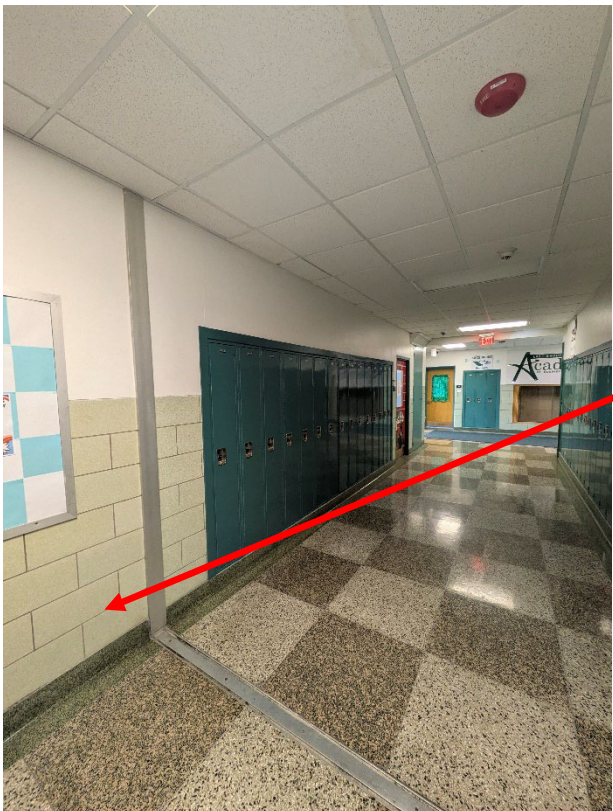
## Appendix B LBP Site Photos



**LBP Surface in Photo**

**Tan Glazed Block within the 1952  
Vintage**

**See Section 2.3 Inspection Report  
for a Summary of Location(s) of  
Lead-Painted Surface(s)**



**LBP Surface in Photo**

**Green Glazed Block throughout  
Corridors in Both the 1952 and 1967  
Vintage**

**See Section 2.3 Inspection Report  
for a Summary of Location(s) of  
Lead-Painted Surface(s)**

## Appendix B LBP Site Photos



**LBP Surface in Photo**

**Blue Glazed Block Within the Pool**

**See Section 2.3 Inspection Report  
for a Summary of Location(s) of  
Lead-Painted Surface(s)**

---

## **Appendix C    General Conditions of Inspection**

1. This inspection was limited to those areas accessible to the inspector. Stohl Environmental, LLC neither accepts nor implies any liability for ACBM or other hazardous materials that may be present between walls, floors or interstitial areas not readily accessible to the inspectors.
2. The results of the laboratory analytical reports that may be contained herein are the product of the knowledge, experience and expertise of the laboratory retained to perform such services. Stohl Environmental, LLC neither accepts nor implies any liability for the sample analysis reports.
3. This report is based on the condition and contents present at the site on the day of the inspection
4. An environmental inspection relies heavily upon identification of homogeneous building areas (materials of like kind), with sampling and laboratory analysis then determined by the quantity of each suspect homogenous material, generally accepted inspection protocols, regulatory requirements, and the inspector's judgment. Specific sample locations are determined with the objective of selecting representative samples. As with any type of sampling, the possibility of obtaining a false positive or false negative does exist, is inherent in the sampling process, and can at times result from the fact that asbestos fibers or other hazardous materials are not always uniformly distributed throughout suspect materials. Although Stohl Environmental attempts to minimize the risk of a false positive or false negative result through a comprehensive inspection protocol, the possibility does exist, and could only be completely eliminated through laboratory analysis of 100% of each suspect material, which of course is not practical



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## **Appendix D    Certifications and Licenses**

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**Department  
of Labor**

DIVISION OF SAFETY & HEALTH LICENSE AND CERTIFICATE UNIT, STATE OFFICE CAMPUS, BLDG. 12, ALBANY, NY 12226

# ASBESTOS HANDLING LICENSE

Stohl Environmental LLC  
3860 California Road, Orchard Park, NY, 14127

License Number: 29408

License Class: FULL

Date of Issue: 02/05/2025

Expiration Date: 02/28/2026

Duly Authorized Representative: Christopher C Stohl

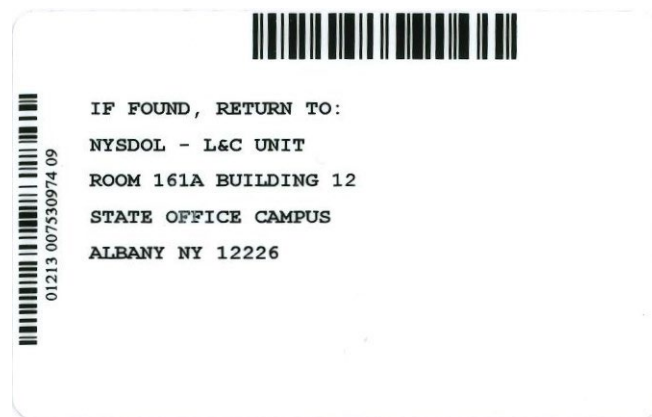
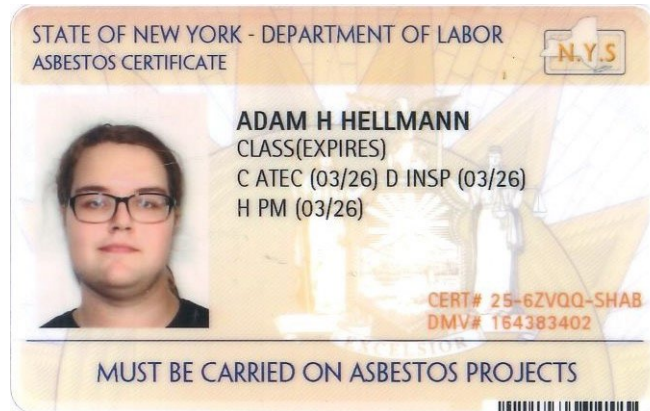
This license has been issued in accordance with applicable provisions of Article 30 of the Labor Law of New York State and of the New York State Codes, Rules and Regulations (12 NYCRR Part 56). It is subject to suspension or revocation for a (1) serious violation of state, federal or local laws with regard to the conduct of an asbestos project, or (2) demonstrated lack of responsibility in the conduct of any job involving asbestos or asbestos material.

This license is valid only for the contractor named above and this license or a photocopy must be prominently displayed at the asbestos project worksite. This license verifies that all persons employed by the licensee on an asbestos project in New York State have been issued an Asbestos Certificate, appropriate for the type of work they perform, by the New York State Department of Labor.

Amy Phillips, Director  
For the Commissioner of Labor

EXCELSIOR

## ADAM HELLMANN (CHEYENNE ROSE)



## NYS ASBESTOS CERTIFICATIONS

AIR MONITOR

PROJECT MONITOR

INSPECTOR



# United States Environmental Protection Agency

This is to certify that

Stohl Environmental, LLC

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires April 20, 2027

LBP-2571-3

Certification #

April 09, 2024

Issued On



A handwritten signature in black ink, appearing to read "Marc Edmonds", is located in the bottom right area of the page.

Marc Edmonds, Chief

Risk Assessment Management Branch 2.



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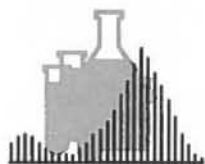
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## **Appendix E    Laboratory Report and Chain of Custody**

Laboratory Reports  
Chain of Custody Documents



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PCM, PLM, TEM & Lead



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Newark, DE19713-5817  
Tel. (302)737-3376 Fax (302) 737-5764

Web: <http://www.battaenv.com> E-mail: [battaenv@battaenv.com](mailto:battaenv@battaenv.com)



EPA Lab ID #DE004



**NVLAP**

Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0

Batch#: N/A

COC#: N/A

## CERTIFICATE OF PLM ANALYSIS

Page 1 of 4

Test Method: ELAP 198.1

Report Date: 10/16/25

### Sampling Data

BLI Project #: R112719

Date Sampled: 10/08/25

Project Name: STOHL ENVIRO - LAKESHORE HIGH SCHOOL, 969 BEACH RD

Sampled By: CLIENT

Date Analyzed: 10/16/25

| Sample ID   |                  | Client-supplied Data |               | Analytical Data |             |             | Reported Results           |                        |
|-------------|------------------|----------------------|---------------|-----------------|-------------|-------------|----------------------------|------------------------|
| Lab Sample# | Client Sample#   | Sample Description   | Material Type | Friable?        | Texture/    | Gross Color | Non-asbestiform Components | Asbestiform Components |
| 1628113     | 1008-LSHS-100A-1 | Boys' Toilet 175     | Plaster Skim  | n/a             | Firm        | White       | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |             |                            |                        |
| 1628114     | 1008-LSHS-100A-2 | Boys' Toilet 160     | Plaster Skim  | n/a             | Firm        | White       | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |             |                            |                        |
| 1628115     | 1008-LSHS-100A-3 | Boys' Toilet 244     | Plaster Skim  | n/a             | Firm        | White       | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |             |                            |                        |
| 1628116     | 1008-LSHS-100B-1 | Boys' Toilet 175     | Plaster Base  | n/a             | Firm        | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |             |                            |                        |
| 1628117     | 1008-LSHS-100B-2 | Boys' Toilet 160     | Plaster Base  | n/a             | Firm        | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |             |                            |                        |

**Note 1** Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.

**Note 2** Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

**Note 3** Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY: APL

QA/QC Officer/Signatory

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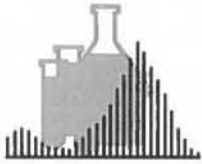
\*This report does not constitute endorsement by NVLAP and/or any other US government agencies. PLM analyses do not fall under the purview of AIHA LAP.

\*The test data pertain only to the items tested. No assumptions or conclusions should be made to materials or samples not analyzed. Furthermore, Batta Laboratories, LLC assumes no responsibility for the accuracy of results influenced by the use of improper collection techniques or equipment.

\*Organically-bound, nonfriable material may interfere with the accurate and reproducible quantification of asbestos. In these cases, the EPA recommends further analysis by a matrix-reduction method. Batta recommends the NY ELAP Item 198.6/198.4 over the Chatfield method. When point count techniques are utilized on organically-bound, nonfriable materials without the EPA-recommended matrix reduction steps, Batta Laboratories assumes no responsibility regarding the accuracy or precision associated with these results. In these cases, Batta employs a modified version of the EPA point count method.

\*WRTA refers to a group of fibrous Amphiboles typically associated with 'high Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

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**NVLAP**  
Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0  
Batch#: N/A  
COC#: N/A

## CERTIFICATE OF PLM ANALYSIS

Page 2 of 4

Test Method: ELAP 198.1

Report Date: 10/16/25

### Sampling Data

BLI Project #: R112719  
Project Name: STOHL ENVIRO - LAKESHORE HIGH SCHOOL, 969 BEACH RD

Date Sampled: 10/08/25

Sampled By: CLIENT

Date Analyzed: 10/16/25

| Sample ID   |                  | Client-supplied Data |               |          | Analytical Data |       |             | Reported Results           |                        |
|-------------|------------------|----------------------|---------------|----------|-----------------|-------|-------------|----------------------------|------------------------|
| Lab Sample# | Client Sample#   | Sample Description   | Material Type | Friable? | Texture/        | Gross | Color       | Non-asbestiform Components | Asbestiform Components |
| 1628118     | 1008-LSHS-100B-3 | Boys' Toilet 244     | Plaster Base  | n/a      |                 |       | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |          | Firm            |       | Homogeneous |                            |                        |
| 1628119     | 1008-LSHS-103A-1 | Boys' Toilet 160     | Grout         | n/a      |                 |       | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |          | Firm            |       | Homogeneous |                            |                        |
| 1628120     | 1008-LSHS-103A-2 | Boys' Toilet 160     | Grout         | n/a      |                 |       | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |          | Firm            |       | Homogeneous |                            |                        |
| 1628121     | 1008-LSHS-320A-1 | Girls' Toilet 250B   | Grout         | n/a      |                 |       | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |          | Firm            |       | Homogeneous |                            |                        |
| 1628122     | 1008-LSHS-320A-2 | Girls' Toilet 254    | Grout         | n/a      |                 |       | Gray        | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |          | Firm            |       | Homogeneous |                            |                        |

**Note 1** Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.

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ANALYST: JJF

REVIEWED BY:

*APL*

QA/QC Officer/Signatory

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\*The test data pertain only to the items tested. No assumptions or conclusions should be made to materials or samples not analyzed. Furthermore, Batta Laboratories, LLC assumes no responsibility for the accuracy of results influenced by the use of improper collection techniques or equipment.

\*Organically-bound, nonfriable material may interfere with the accurate and reproducible quantification of asbestos. In these cases, the EPA recommends further analysis by a matrix-reduction method. Batta recommends the NY ELAP Item 198.6/198.4 over the Chatfield method. When point count techniques are utilized on organically-bound, nonfriable materials without the EPA-recommended matrix reduction steps, Batta Laboratories assumes no responsibility regarding the accuracy or precision associated with these results. In these cases, Batta employs a modified version of the EPA point count method.

\*WRTA refers to a group of fibrous Amphiboles typically associated with 'Libby Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

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NY ELAP LAB# 11993 for  
PCM, PLM, TEM & Lead

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EPA Lab ID #DE004



**NVLAP**

Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0

Batch#: N/A

COC#: N/A

## CERTIFICATE OF PLM ANALYSIS

Page 3 of 4

Test Method: ELAP 198.1

Report Date: 10/16/25

Date Sampled: 10/08/25

Sampled By: CLIENT

Date Analyzed: 10/16/25

### Sampling Data

BLI Project #: R112719

Project Name: STOHL ENVIRO - LAKESHORE HIGH SCHOOL, 969 BEACH RD

| Sample ID   |                  | Client-supplied Data |               | Analytical Data |             |       |       | Reported Results           |                        |
|-------------|------------------|----------------------|---------------|-----------------|-------------|-------|-------|----------------------------|------------------------|
| Lab Sample# | Client Sample#   | Sample Description   | Material Type | Friable?        | Texture/    | Gross | Color | Non-asbestiform Components | Asbestiform Components |
| 1628123     | 1008-LSHS-320B-1 | Girls' Toilet 250B   | Thinset       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628124     | 1008-LSHS-320B-2 | Girls' Toilet 254    | Thinset       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628125     | 1008-LSHS-321A-1 | Girls' Toilet 255    | Grout         | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628126     | 1008-LSHS-321A-2 | Girls' Toilet 256    | Grout         | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628127     | 1008-LSHS-321B-1 | Girls' Toilet 257    | Mud Bed       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |

**Note 1** Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.

**Note 2** Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

**Note 3** Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY:

QA/QC Officer/Signatory

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\*WRTA refers to a group of fibrous Amphiboles typically associated with 'Libby Amphibole'. Within this classification are: winchite, richterite, tremolite, and actinolite.

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EPA Lab ID #DE004



**NVLAP**

Lab Code: 101032-D

Dept. Code: PLM

Rev. #: 0  
Batch#: N/A  
COC#: N/A

## CERTIFICATE OF PLM ANALYSIS

Page 4 of 4

Test Method: ELAP 198.1

Report Date: 10/16/25

### Sampling Data

BLI Project #: R112719  
Project Name: STOHL ENVIRO - LAKESHORE HIGH SCHOOL, 969 BEACH RD

Date Sampled: 10/08/25

Sampled By: CLIENT

Date Analyzed: 10/16/25

| Sample ID   |                  | Client-supplied Data |               | Analytical Data |             |       |       | Reported Results           |                        |
|-------------|------------------|----------------------|---------------|-----------------|-------------|-------|-------|----------------------------|------------------------|
| Lab Sample# | Client Sample#   | Sample Description   | Material Type | Friable?        | Texture/    | Gross | Color | Non-asbestiform Components | Asbestiform Components |
| 1628128     | 1008-LSHS-321B-2 | Girls' Toilet 258    | Mud Bed       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628129     | 1008-LSHS-322A-1 | Pool 125             | Grout         | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628130     | 1008-LSHS-322A-2 | Pool 125             | Grout         | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628131     | 1008-LSHS-322B-1 | Pool 125             | Mud Bed       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |
| 1628132     | 1008-LSHS-322B-2 | Pool 125             | Mud Bed       | n/a             | Firm        |       | Gray  | 100% Non-fibrous Material  | No Asbestos Found      |
|             |                  |                      |               |                 | Homogeneous |       |       |                            |                        |

**Note 1** Due to limitations of the EPA PLM method, floor tiles may yield false negative (<1%) results by this method. As such, the EPA recommends further analysis by electron microscopy. Batta recommends the NY 198.4 over the Chatfield method.

**Note 2** Unless otherwise specified, Tr=Trace and correlates to <0.25% (based on a 400-point EPA point count).

**Note 3** Materials containing vermiculite are not good candidates for analysis using standard EPA 600 PLM protocol. Results may be low-biased due to inherent limitations caused by the material. The EPA recommends that vermiculite attic insulation (VAI) be prepped and analyzed using EPA 600/R-04/004, known as "The Cincinnati Method".

ANALYST: JJF

REVIEWED BY:

*APL*

QA/QC Officer/Signatory

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## Chain of Custody Document

2

R112719  
(198.1)

Submitted to: (Lab Name)

Batta

STOHL Job #

2025-330

Client: Lakeshore Central School District

Contact:

Building: Lakeshore High School

Location: 969 Beach Road, Angola, NY 14006

### LEAD

Wipes \_\_\_\_\_ Soil: \_\_\_\_\_ Bulk: \_\_\_\_\_

\*ASTM wipes were used\*

### PCB's

EPA 8082 \_\_\_\_\_

### Turnaround

RUSH \_\_\_\_\_ Hr

☐ 24 Hour ☒ 72 Hour

☐ 48 Hour ☐ 5 Day

| HAN # | Material Description                              | Sample #          | Location of Sample                   |
|-------|---------------------------------------------------|-------------------|--------------------------------------|
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 1 | Boys Toilet 175                      |
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 2 | Boys Toilet 160                      |
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 3 | Boys Toilet 244                      |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 1 | Boys Toilet 175                      |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 2 | Boys Toilet 160                      |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 3 | Boys Toilet 244                      |
| 103A  | Ceramic Wall Tile - Grout                         | 1008-LSHS-103A- 1 | Boys Toilet 160                      |
| 103A  | Ceramic Wall Tile - Grout                         | 1008-LSHS-103A- 2 | Boys Toilet 160                      |
| 103B  | Ceramic Wall Tile - Mastic - White                | 1008-LSHS-103B- 1 | Boys Toilet 160                      |
| 103B  | Ceramic Wall Tile - Mastic - White                | 1008-LSHS-103B- 2 | Boys Toilet 160                      |
| 207   | 2' x 4' Ceiling Tile - Sand Pebble Texture        | 1008-LSHS-207- 1  | Girls Toilet 175                     |
| 207   | 2' x 4' Ceiling Tile - Sand Pebble Texture        | 1008-LSHS-207- 2  | Girls Toilet 254                     |
| 320A  | Ceramic Floor Tile - Grout                        | 1008-LSHS-320A- 1 | Girls Toilet 250B                    |
| 320A  | Ceramic Floor Tile - Grout                        | 1008-LSHS-320A- 2 | Girls Toilet 254                     |
| 320B  | Ceramic Floor Tile - Thin Set                     | 1008-LSHS-320B- 1 | Girls Toilet 250B                    |
| 320B  | Ceramic Floor Tile - Thin Set                     | 1008-LSHS-320B- 2 | Girls Toilet 254                     |
| 321A  | Bathroom Ceramic Floor Tile - Grout               | 1008-LSHS-321A- 1 | Girls Toilet 254                     |
| 321A  | Bathroom Ceramic Floor Tile - Grout               | 1008-LSHS-321A- 2 | Girls Toilet 254                     |
| 321B  | Bathroom Ceramic Floor Tile - Mud Bed             | 1008-LSHS-321B- 1 | Girls Toilet 254                     |
| 321B  | Bathroom Ceramic Floor Tile - Mud Bed             | 1008-LSHS-321B- 2 | Girls Toilet 254                     |
| 322A  | Pool Deck Ceramic Floor Tile - Grout              | 1008-LSHS-322A- 1 | Pool 125                             |
| 322A  | Pool Deck Ceramic Floor Tile - Grout              | 1008-LSHS-322A- 2 | Pool 125                             |
| 322B  | Pool Deck Ceramic Floor Tile - Mud Bed            | 1008-LSHS-322B- 1 | Pool 125                             |
| 322B  | Pool Deck Ceramic Floor Tile - Mud Bed            | 1008-LSHS-322B- 2 | Pool 125                             |
| 500   | Duct Seam Mastic - Light Grey                     | 1008-LSHS-500- 1  | Boys Toilet 244                      |
| 500   | Duct Seam Mastic - Light Grey                     | 1008-LSHS-500- 2  | 2nd Floor Corridor Outside Vestibule |

Note 1: Stop at first positive for homogeneous materials. Perform full NYS ELAP PLM/TEM Protocol for all samples.

Notes:

Please e-mail lab results to labs@stohlenv.com

☒ If checked, also e-mail results to: crose@stohlenv.com

Sampled By:

*Cheyenne Rose*

Print Name

Cheyenne Rose

Date: 10/8/2025

Relinquished By:

*Cheyenne Rose*

Print Name

Cheyenne Rose

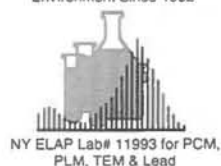
Date: 10/10/2025

Received By:

*[Signature]*

*[Signature]*

Date: 10/13/25 10:35



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**CERTIFICATE OF PLM ANALYSIS**

PLM Test Method: New York State Method Item No. 198.6

**CERTIFICATE OF TEM ANALYSIS**

TEM Test Method: New York State Method Item No. 198.4



EPA Lab ID #DE004

**NVLAP**

Lab Code: 101032-0

Page 1 of 1

Report Date: 10/16/2025

Revision #: 0

## Sampling Data

BLI Project #: R112719  
Project Name: STOHL ENVIRO- 2025-330, Lakeshore CSD  
Project Location: Lakeshore HS: 969 Beach Road, Angola, NY 14006

Date Sampled: 10/8/2025  
Sampled By: Client  
Date Analyzed: 10/16/2025

## Analytical Data

| Sample ID           |                        | Sample Description      |                                      |                      |              | Gravimetric Data  |                       | PLM-NOB Analytical Results |                                                  |                                      | TEM-NOB Analytical Results             |                                      |
|---------------------|------------------------|-------------------------|--------------------------------------|----------------------|--------------|-------------------|-----------------------|----------------------------|--------------------------------------------------|--------------------------------------|----------------------------------------|--------------------------------------|
| Lab Sample #<br>PLM | Client Sample #<br>TEM | Homogenous Area ID.     | Sample Location                      | Material Description | Sample Color | Ashed Residue (%) | Insoluble Residue (%) | Non-Asbestos Content       |                                                  | Asbestos Content By PLM <sup>2</sup> | Non-Asbestos Content                   |                                      |
|                     |                        |                         |                                      |                      |              |                   |                       | Other Content (%)          | Inorganic and Other Fibrous Content <sup>1</sup> |                                      | Inorganic Fibrous Content <sup>1</sup> | Asbestos Content By TEM <sup>2</sup> |
| 1628134             | 1628209                | 1008-LSHS-103B-1<br>n/a | Boys Toilet 160                      | CWT Mastic           | White        | 82.65             | 0.31                  | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |
| 1628135             | 1628210                | 1008-LSHS-103B-2<br>n/a | Boys Toilet 160                      | CWT Mastic           | White        | 82.12             | 0.84                  | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |
| 1628136             | 1628211                | 1008-LSHS-207-1<br>n/a  | Girls Toilet 175                     | 2x4 CT               | White        | 90.00             | 32.91                 | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |
| 1628137             | 1628212                | 1008-LSHS-207-2<br>n/a  | Girls Toilet 254                     | 2x4 CT               | White        | 90.32             | 36.13                 | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |
| 1628138             | 1628213                | 1008-LSHS-500-1<br>n/a  | Boys Toilet 244                      | Duct Seam Mastic     | Light Gray   | 56.32             | 12.99                 | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |
| 1628139             | 1628214                | 1008-LSHS-500-2<br>n/a  | 2nd Floor Corridor Outside Vestibule | Duct Seam Mastic     | Light Gray   | 54.62             | 14.92                 | 100.00% Other, Particulate | N/A                                              | Inconclusive- None Detected          | 100% Other, Particulate                | None Detected                        |

PLM

Analyst(s): John Flanagan

TEM

Analyst(s): Angela Lewis

Reviewed By:

*APL*

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*This method is not recommended for nonorganically bound or friable samples, as the granular nature of many of these samples can produce a false negative. PLM methods are sufficient.*

<sup>1</sup> Unless otherwise specified in the report, contents of non-asbestos inorganic fibers are not given.

<sup>2</sup> Results reported are based on final residue through matrix reduction. Due to resolution differences, discrepancies between TEM results and PLM results are expected. Based on a possible analytical conditions within published methodology, method detection limits (MDL) of 0.05% (for TEM) and 0.20% (for PLM) have been determined.

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\*Polarized-light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.\*





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# Chain of Custody Document

R12719  
(198.6/198.4)

Submitted to: (Lab Name)

Batta

STOHL Job #

2025-330

|                                                                                                                                                                                      |                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Client: Lakeshore Central School District                                                                                                                                            | Contact:                                   |
| Building: Lakeshore High School                                                                                                                                                      | Location: 969 Beach Road, Angola, NY 14006 |
| <b>LEAD</b><br>Wipes _____ Soil: _____ Bulk: _____<br>*ASTM wipes were used*                                                                                                         | <b>PCB's</b><br>EPA 8082 _____             |
| <b>Tumaround</b><br>RUSH _____ Hr<br><input type="checkbox"/> 24 Hour <input checked="" type="checkbox"/> 72 Hour<br><input type="checkbox"/> 48 Hour <input type="checkbox"/> 5 Day |                                            |

| HAN # | Material Description                              | Sample #          | Location of Sample                |
|-------|---------------------------------------------------|-------------------|-----------------------------------|
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 1 | Boys Toilet 175                   |
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 2 | Boys Toilet 160                   |
| 100A  | Plaster Skim Coat - White - 1952 Building Vintage | 1008-LSHS-100A- 3 | Boys Toilet 244                   |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 1 | Boys Toilet 175                   |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 2 | Boys Toilet 160                   |
| 100B  | Plaster Base Coat - Grey - 1952 Building Vintage  | 1008-LSHS-100B- 3 | Boys Toilet 244                   |
| 103A  | Ceramic Wall Tile - Grout                         | 1008-LSHS-103A- 1 | Boys Toilet 160                   |
| 103A  | Ceramic Wall Tile - Grout                         | 1008-LSHS-103A- 2 | Boys Toilet 160                   |
| 103B  | Ceramic Wall Tile - Mastic - White                | 1008-LSHS-103B- 1 | Boys Toilet 160                   |
| 103B  | Ceramic Wall Tile - Mastic - White                | 1008-LSHS-103B- 2 | Boys Toilet 160                   |
| 207   | 2' x 4' Ceiling Tile - Sand Pebble Texture        | 1008-LSHS-207- 1  | Girls Toilet 175                  |
| 207   | 2' x 4' Ceiling Tile - Sand Pebble Texture        | 1008-LSHS-207- 2  | Girls Toilet 254                  |
| 320A  | Ceramic Floor Tile - Grout                        | 1008-LSHS-320A- 1 | Girls Toilet 250B                 |
| 320A  | Ceramic Floor Tile - Grout                        | 1008-LSHS-320A- 2 | Girls Toilet 254                  |
| 320B  | Ceramic Floor Tile - Thin Set                     | 1008-LSHS-320B- 1 | Girls Toilet 250B                 |
| 320B  | Ceramic Floor Tile - Thin Set                     | 1008-LSHS-320B- 2 | Girls Toilet 254                  |
| 321A  | Bathroom Ceramic Floor Tile - Grout               | 1008-LSHS-321A- 1 | Girls Toilet 254                  |
| 321A  | Bathroom Ceramic Floor Tile - Grout               | 1008-LSHS-321A- 2 | Girls Toilet 254                  |
| 321B  | Bathroom Ceramic Floor Tile - Mud Bed             | 1008-LSHS-321B- 1 | Girls Toilet 254                  |
| 321B  | Bathroom Ceramic Floor Tile - Mud Bed             | 1008-LSHS-321B- 2 | Girls Toilet 254                  |
| 322A  | Pool Deck Ceramic Floor Tile - Grout              | 1008-LSHS-322A- 1 | Pool 125                          |
| 322A  | Pool Deck Ceramic Floor Tile - Grout              | 1008-LSHS-322A- 2 | Pool 125                          |
| 322B  | Pool Deck Ceramic Floor Tile - Mud Bed            | 1008-LSHS-322B- 1 | Pool 125                          |
| 322B  | Pool Deck Ceramic Floor Tile - Mud Bed            | 1008-LSHS-322B- 2 | Pool 125                          |
| 500   | Duct Seam Mastic - Light Grey                     | 1008-LSHS-500- 1  | Boys Toilet 244                   |
| 500   | Duct Seam Mastic - Light Grey                     | 1008-LSHS-500- 2  | 2nd Floor Corridor Outside Vestib |

Note 1: Stop at first positive for homogeneous materials. Perform full NYS ELAP PLM/TEM Protocol for all samples.

Notes:

Please e-mail lab results to [labs@stohlenvironmental.com](mailto:labs@stohlenvironmental.com)

☒ If checked, also e-mail results to: [crose@stohlenvironmental.com](mailto:crose@stohlenvironmental.com)

|                                       |                                  |                         |
|---------------------------------------|----------------------------------|-------------------------|
| Sampled By: <u>Cheyenne Rose</u>      | Print Name: <u>Cheyenne Rose</u> | Date: <u>10/8/2025</u>  |
| Relinquished By: <u>Cheyenne Rose</u> | Print Name: <u>Cheyenne Rose</u> | Date: <u>10/10/2025</u> |
| Received By: <u>[Signature]</u>       | Date: <u>10/13/25 10:35</u>      |                         |

## SECTION 004113.1 – BID FORM – GENERAL TRADES

### PART 1 - GENERAL

#### 1.1 CONTRACTOR INFORMATION

- A. Bidder's Full Name \_\_\_\_\_
1. Address \_\_\_\_\_
2. City, State, Zip \_\_\_\_\_
3. Telephone # \_\_\_\_\_
4. Email \_\_\_\_\_
5. Date \_\_\_\_\_
- B. Post Bid Interview Contact
1. Name \_\_\_\_\_
2. Telephone # \_\_\_\_\_

#### 1.2 ALLOWANCES

- A. Bidder's signature on the following line acknowledges that the allowances for this contract as specified in "Section 012100 – Allowances" have been included in the base bid amount for this contract proposal and that the Contractor has read and will comply with the requirements of Article 11 of AIA Document A232-2019 General Conditions.

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

#### 1.3 1.2 BID BOND

- A. The undersigned Bidder agrees to execute a contract for this work in the below amount and to furnish surety within 10 days after Notice of Award. Failure to do so will require the undersigned to forfeit the following amount of five percent (5%) of their base bid as required by the "Invitation to Bid"

Bid Bond Amount: \_\_\_\_\_

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



1.3 PROJECT SITE INSPECTION

- A. Bidder's signature on the following line indicates that a representative of the company that has been involved in the preparation of this bid, has visited the project site, is familiar with the scope of the project, and has inspected the existing conditions.

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

1.4 ADDENDA

- A. Bidder acknowledges receipt of the following Addendums.

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

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

1.4 WORK SCHEDULE

- A. Bidder's signature on the following line indicates that the contractor shall proceed with work in a timely manner following receipt of written "Notice to Proceed" in accordance with the General Conditions of the contract and shall provide final completion of the work by **date indicated in the specifications**.

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

1.6 IMMEDIATE SUBMITTALS

- A. Bidders signature on the following line indicates that the contractor understands the requirements of Division 1 of this specification's manual including the General Conditions and will provide all requirements of such sections including insurance certificates, progress schedules, schedule of values, schedule of submittals, etc.

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

1.7 SCHEDULE OF UNIT PRICES

- A. The following unit prices may be used for changes to the work. Unit process shall include all labor, materials, fittings, insulation, tools, equipment, handling, storage, hoisting, distribution, protection of materials, clean up, field and office supervision, fringe benefits, overhead and profit of any kind and insurance. No further charge except the unit price shall be made for a change. The unit prices apply for the NET change in quantity for each change request issued. If Payment and Performance bonds are required, a net change percentage will be added to the net

total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

UNIT PRICE #G1

Cost per square foot of wall paint – interior 3 coat system as described in the specifications and drawings.

\$\_\_\_\_\_ per S.F.

UNIT PRICE #G2

Cost per square foot of acoustic ceiling tile as described in the specifications and drawings.

\$\_\_\_\_\_ per S.F.

UNIT PRICE #G3

Cost per square foot of ceramic pool tile CT-4, CT-6, CT-7 as described in the specifications and drawings.

\$\_\_\_\_\_ per S.F.

1.5 BASE BID AMOUNT

- A. The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Young + Wright Architectural, and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work hereby agrees to furnish all material, labor, equipment, and services, including all scheduled allowances, necessary to complete the construction of the work for the above named Project and Bid Package, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

Base Bid: (written amount) \_\_\_\_\_

Base Bid: (numerical amount) \_\_\_\_\_

1.9 NON-COLLUSIVE AFFIDAVIT

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

Being first duly sworn deposes and says that:

1. He/She is the (Owner, Partner, Officer, representative, or agent) of \_\_\_\_\_, the bidder that has submitted the attached bid.
  - a. By submission of this bid, each person signing on behalf of a bidder certifies, and in the case of a joint bid each party thereto certified as to its own organization, under penalty of perjury, that to the best of knowledge and belief.
    - 1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting

competition, as to any matter relating to such prices with any other bidder or with any competitor.

- 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening directly or indirectly, to any other bidder or to any competitor.
- 3) No attempt has been made or will be by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

b. A bid shall not be considered for award nor shall any award be made where a., 1, 2,3, above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish, with the bid a signed statement which sets forth in detail the reason therefore. Where 1, 2 and 3, above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency of the official therefore to which the bid is made, or designee, determines that such disclosure was not made for the purpose of restricting completion.

c. The fact that a bidder (a) has published price lists, rates or tariffs covering the items being produced, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within more, a disclosure within the meaning of subparagraph one (a).

2. Any Bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have authorized by the board of directors of the bidder and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificates as to non-collusion as the act and deed of the corporation.

Signed: \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

My commission expires: \_\_\_\_\_

Notary Public Stamp:

## 1.6 1.10 SEXUAL HARASSMENT PREVENTION CERTIFICATION

- A. By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of

its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

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

#### 1.7 IRAN DIVESTMENT ACT CERTIFICATION

- A. As a result of the Iran Divestment Act of 2012 (Act), Chapter 1 of the 2012 Laws of New York, a new provision has been added to the State Finance Law (SFL), §165-a, effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list (prohibited entities list) of “persons” who are engaged in “investment activities in Iran” (both are defined terms in the law). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act’s effective date, at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, Bidder/Contractor (or any assignee) certifies that once the prohibited entities list is posted on the OGS website, it will not utilize on such Contract any subcontractor that is identified on the prohibited entities list.

Additionally, Bidder/Contractor is advised that once the list is posted on the OGS website, any Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to the solicitation, must certify at the time the Contract is renewed, extended or assigned that it is not included on the prohibited entities list.

During the term of the Contract, should the New York State Education Department (AGENCY) receive information that a person is in violation of the above-referenced certification, AGENCY will offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then AGENCY shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

AGENCY reserves the right to reject any bid or request for assignment for an entity that appears on the prohibited entities list prior to the award of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the prohibited entities list after contract award.

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

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

Title: \_\_\_\_\_

Company: \_\_\_\_\_

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

1.15 CERTIFICATE AS TO A CORPORATE BIDDER

Corporate Seal

Name of Corporate (Bidder): \_\_\_\_\_

Print Name of Authorized Person: \_\_\_\_\_

Signature of Authorized Person: \_\_\_\_\_

Title of Authorized Person: \_\_\_\_\_

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

1.16 DEPARTMENT OF LABOR CONTRACTOR REGISTRY CERTIFICATION  
(EFFECTIVE DECEMBER 2024)

New York Labor Law Section 220-I establishes a registration system for contractors and subcontractors involved in public work projects. This law requires contractors and subcontractors to register with the Department of Labor, providing detailed information about their business and compliance with labor laws. This registration must be completed prior to bidding on public work projects or commencing work on public work projects or covered private projects that are subject to the prevailing wage pursuant to Sections 224-a, 224-d, 224-e

No contractor shall bid on a contract for public work unless such contractor is registered pursuant to this section. In the case of a covered project subject to section two hundred twenty-four-a or two hundred twenty-four-d of this article, or other projects that are privately owned and subject to provisions of this article, contractors must register prior to commencing any work on a covered project. Subcontractors must be registered prior to commencing any work on a covered project. Further, each contractor must submit their certificate of registration at the time the bid is made. Applications for registration shall not be accepted as a substitute for a certificate of registration for the purposes of this section.

Certification below indicates that this registration has been completed prior to bidding:

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

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

Prime Contractor NYS DOL Contract Registration #: \_\_\_\_\_

END OF SECTION 004113.1

SECTION 004113.2 – BID FORM – SITE

PART 1 - GENERAL

1.1 CONTRACTOR INFORMATION

- A. Bidder's Full Name \_\_\_\_\_
1. Address \_\_\_\_\_
2. City, State, Zip \_\_\_\_\_
3. Telephone # \_\_\_\_\_
4. Email \_\_\_\_\_
5. Date \_\_\_\_\_
- B. Post Bid Interview Contact
1. Name \_\_\_\_\_
2. Telephone # \_\_\_\_\_

1.2 ALLOWANCES

- A. Bidder's signature on the following line acknowledges that the allowances for this contract as specified in "Section 012100 – Allowances" have been included in the base bid amount for this contract proposal and that the Contractor has read and will comply with the requirements of Article 11 of AIA Document A232-2019 General Conditions.

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

1.3 1.2 BID BOND

- A. The undersigned Bidder agrees to execute a contract for this work in the below amount and to furnish surety within 10 days after Notice of Award. Failure to do so will require the undersigned to forfeit the following amount of five percent (5%) of their base bid as required by the "Invitation to Bid"

Bid Bond Amount: \_\_\_\_\_

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

1.3 PROJECT SITE INSPECTION

- A. Bidder's signature on the following line indicates that a representative of the company that has been involved in the preparation of this bid, has visited the project site, is familiar with the scope of the project, and has inspected the existing conditions.

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

1.4 ADDENDA

- A. Bidder acknowledges receipt of the following Addendums.

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

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

1.4 WORK SCHEDULE

- A. Bidder's signature on the following line indicates that the contractor shall proceed with work in a timely manner following receipt of written "Notice to Proceed" in accordance with the General Conditions of the contract and shall provide final completion of the work by **date indicated in the specifications**.

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

1.6 IMMEDIATE SUBMITTALS

- A. Bidders signature on the following line indicates that the contractor understands the requirements of Division 1 of this specification's manual including the General Conditions and will provide all requirements of such sections including insurance certificates, progress schedules, schedule of values, schedule of submittals, etc.

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

1.7 SCHEDULE OF UNIT PRICES

- A. The following unit prices may be used for changes to the work. Unit process shall include all labor, materials, fittings, insulation, tools, equipment, handling, storage, hoisting, distribution, protection of materials, clean up, field and office supervision, fringe benefits, overhead and profit of any kind and insurance. No further charge except the unit price shall be made for a change. The unit prices apply for the NET change in quantity for each change request issued. If Payment and Performance bonds are required, a net change percentage will be added to the net

total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

**UNIT PRICE #L1**

Cost per settled cubic yard, installed, for additional imported topsoil furnished and placed as described in Section 32 9201.

\$ \_\_\_\_\_ per settled C.Y. installed

**UNIT PRICE #L2**

Cost per linear foot for additional 4" storm water management trench (SMT) piping, filter fabric and drainage stone, furnished and placed as described in Section 33 4001. This includes trenching and removals.

\$ \_\_\_\_\_ per L.F. installed

**UNIT PRICE #L3**

Cost per linear foot, installed, for additional 8" storm water management trench (SMT) piping, filter fabric and drainage stone, furnished and placed as described in Section 33 4001. This includes trenching and removals.

\$ \_\_\_\_\_ per L.F. installed

**UNIT PRICE #L4**

Cost per linear foot, installed, for additional 12" storm pipe (ST) piping and backfill, furnished and placed as described in Section 33 4001. This includes trenching and removals.

\$ \_\_\_\_\_ per L.F. installed

**UNIT PRICE #L5**

Cost per cubic yard, installed for undercutting where unsatisfactory soils are discovered. This includes excavation, removal and haul away of unsuitable material, backfill and compaction with imported granular material as specified in Section 31 1201. **Note: 1,500 cubic yards to be included in Base Bid.**

\$ \_\_\_\_\_ per C.Y. installed

**UNIT PRICE #L6**

Cost per cubic yard, installed, for undercutting where unsatisfactory soils are discovered. This includes excavation, removal and haul away of unsuitable material, backfill and compaction with imported granular material as specified in Section 31 1201. **Note: 1,000 cubic yards to be included in Base Bid.**

\$ \_\_\_\_\_ per C.Y. installed

**UNIT PRICE #L7**

Cost per square yard, installed, of additional heavy-duty asphalt, stabilization fabric and stone subbase as described in Section 32 1201. This includes excavation and removals for placement of heavy-duty asphalt.

\$ \_\_\_\_\_ per S.Y. installed

**UNIT PRICE #L8**

Cost per square foot, installed, to furnish and install new standard sidewalk(s) as described in Section 32 1301 and as detailed. This includes excavation and removals for placement of standard concrete walks.

\$ \_\_\_\_\_ per S.F. installed



**UNIT PRICE #L9**

Cost per square foot, installed, to Furnish and install heavy duty sidewalk(s) as described in Section 32 1301 and as detailed. This includes excavation and removals for placement of heavy duty concrete walks.

\$ \_\_\_\_\_ per S.F. installed

**UNIT PRICE #L10**

Cost per linear foot, installed, for additional 5" X 16" concrete curb, furnished and installed as described in Section 32 1301 and as detailed.

\$ \_\_\_\_\_ per L.F. installed

**UNIT PRICE #L11**

Cost per square yard, installed, for additional sodded lawn as described in Section 32 9201. This includes fine grading and sodding.

\$ \_\_\_\_\_ per S.Y. installed

**UNIT PRICE #L12**

Cost per cubic yard, removed, for rock excavation and removal off site as described in Section 31 2201. **Note: 250 cubic yards are included in Base Bid.**

\$ \_\_\_\_\_ per C.Y. removed

**UNIT PRICE #L13**

Cost per square yard, installed, for additional Woven soil stabilization fabric furnished and installed as described in Section 32 1201.

\$ \_\_\_\_\_ per S.Y. installed

**UNIT PRICE #L14**

Cost per linear foot, installed, for surface preparation/priming, providing and installation of 12" wide self-adhering waterproof membrane as specified in Section 32 1201. **Note: Providing and installing 1,000 linear feet of 12" wide self-adhering waterproof membrane is in the Base Bid.**

\$ \_\_\_\_\_ per L.F. installed

**BASE BID AMOUNT**

- A. The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Young + Wright Architectural, and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work hereby agrees to furnish all material, labor, equipment, and services, including all scheduled allowances, necessary to complete the construction of the work for the above named Project and Bid Package, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

Base Bid: (written amount) \_\_\_\_\_

Base Bid: (numerical amount) \_\_\_\_\_

1.9 NON-COLLUSIVE AFFIDAVIT

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

Being first duly sworn deposes and says that:

1. He/She is the (Owner, Partner, Officer, representative, or agent) of \_\_\_\_\_, the bidder that has submitted the attached bid.
  - a. By submission of this bid, each person signing on behalf of a bidder certifies, and in the case of a joint bid each party thereto certified as to its own organization, under penalty of perjury, that to the best of knowledge and belief.
    - 1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.
    - 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening directly or indirectly, to any other bidder or to any competitor.
    - 3) No attempt has been made or will be by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
  - b. A bid shall not be considered for award nor shall any award be made where a., 1, 2,3, above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish, with the bid a signed statement which sets forth in detail the reason therefore. Where 1, 2 and 3, above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency of the official therefore to which the bid is made, or designee, determines that such disclosure was not made for the purpose of restricting completion.
  - c. The fact that a bidder (a) has published price lists, rates or tariffs covering the items being produced, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within more, a disclosure within the meaning of subparagraph one (a).
2. Any Bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have authorized by the board of directors of the bidder and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificates as to non-collusion as the act and deed of the corporation.

Signed: \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

My commission expires: \_\_\_\_\_

Notary Public Stamp:

1.5 1.10 SEXUAL HARASSMENT PREVENTION CERTIFICATION

- A. By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

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

1.6 IRAN DIVESTMENT ACT CERTIFICATION

- A. As a result of the Iran Divestment Act of 2012 (Act), Chapter 1 of the 2012 Laws of New York, a new provision has been added to the State Finance Law (SFL), §165-a, effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list (prohibited entities list) of “persons” who are engaged in “investment activities in Iran” (both are defined terms in the law). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act’s effective date, at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, Bidder/Contractor (or any assignee) certifies that once the prohibited entities list is posted on the OGS website, it will not utilize on such Contract any subcontractor that is identified on the prohibited entities list.

Additionally, Bidder/Contractor is advised that once the list is posted on the OGS website, any Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to the solicitation, must certify at the time the Contract is renewed, extended or assigned that it is not included on the prohibited entities list.

During the term of the Contract, should the New York State Education Department (AGENCY) receive information that a person is in violation of the above-referenced certification, AGENCY will offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then AGENCY shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

AGENCY reserves the right to reject any bid or request for assignment for an entity that appears on the prohibited entities list prior to the award of a contract, and to pursue a responsibility

review with respect to any entity that is awarded a contract and appears on the prohibited entities list after contract award.

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

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

Title: \_\_\_\_\_

Company: \_\_\_\_\_

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

#### 1.15 CERTIFICATE AS TO A CORPORATE BIDDER

Corporate Seal

Name of Corporate (Bidder): \_\_\_\_\_

Print Name of Authorized Person: \_\_\_\_\_

Signature of Authorized Person: \_\_\_\_\_

Title of Authorized Person: \_\_\_\_\_

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

#### 1.16 DEPARTMENT OF LABOR CONTRACTOR REGISTRY CERTIFICATION (EFFECTIVE DECEMBER 2024)

New York Labor Law Section 220-I establishes a registration system for contractors and subcontractors involved in public work projects. This law requires contractors and subcontractors to register with the Department of Labor, providing detailed information about their business and compliance with labor laws. This registration must be completed prior to bidding on public work projects or commencing work on public work projects or covered private projects that are subject to the prevailing wage pursuant to Sections 224-a, 224-d, 224-e

No contractor shall bid on a contract for public work unless such contractor is registered pursuant to this section. In the case of a covered project subject to section two hundred twenty-four-a or two hundred twenty-four-d of this article, or other projects that are privately owned and subject to provisions of this article, contractors must register prior to commencing any work on a covered project. Subcontractors must be registered prior to commencing any work on a covered project. Further, each contractor must submit their certificate of registration at the time the bid is made. Applications for registration shall not be accepted as a substitute for a certificate of registration for the purposes of this section.

Certification below indicates that this registration has been completed prior to bidding:

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

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

Prime Contractor NYS DOL Contract Registration #: \_\_\_\_\_

END OF SECTION 004113.2

## SECTION 004113.3 – BID FORM – ELECTRICAL

### PART 1 - GENERAL

#### 1.1 CONTRACTOR INFORMATION

- A. Bidder's Full Name \_\_\_\_\_
1. Address \_\_\_\_\_
2. City, State, Zip \_\_\_\_\_
3. Telephone # \_\_\_\_\_
4. Email \_\_\_\_\_
5. Date \_\_\_\_\_
- B. Post Bid Interview Contact
1. Name \_\_\_\_\_
2. Telephone # \_\_\_\_\_

#### 1.2 ALLOWANCES

- A. Bidder's signature on the following line acknowledges that the allowances for this contract as specified in "Section 012100 – Allowances" have been included in the base bid amount for this contract proposal and that the Contractor has read and will comply with the requirements of Article 11 of AIA Document A232-2019 General Conditions.

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

#### 1.3 1.2 BID BOND

- A. The undersigned Bidder agrees to execute a contract for this work in the below amount and to furnish surety within 10 days after Notice of Award. Failure to do so will require the undersigned to forfeit the following amount of five percent (5%) of their base bid as required by the "Invitation to Bid"

Bid Bond Amount: \_\_\_\_\_

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

1.3 PROJECT SITE INSPECTION

- A. Bidder's signature on the following line indicates that a representative of the company that has been involved in the preparation of this bid, has visited the project site, is familiar with the scope of the project, and has inspected the existing conditions.

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

1.4 ADDENDA

- A. Bidder acknowledges receipt of the following Addendums.

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

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

1.4 WORK SCHEDULE

- A. Bidder's signature on the following line indicates that the contractor shall proceed with work in a timely manner following receipt of written "Notice to Proceed" in accordance with the General Conditions of the contract and shall provide final completion of the work by **date indicated in the specifications**.

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

1.6 IMMEDIATE SUBMITTALS

- A. Bidders signature on the following line indicates that the contractor understands the requirements of Division 1 of this specification's manual including the General Conditions and will provide all requirements of such sections including insurance certificates, progress schedules, schedule of values, schedule of submittals, etc.

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

1.7 SCHEDULE OF UNIT PRICES

- A. The following unit prices may be used for changes to the work. Unit process shall include all labor, materials, fittings, insulation, tools, equipment, handling, storage, hoisting, distribution, protection of materials, clean up, field and office supervision, fringe benefits, overhead and profit of any kind and insurance. No further charge except the unit price shall be made for a change. The unit prices apply for the NET change in quantity for each change request issued. If Payment and Performance bonds are required, a net change percentage will be added to the net

total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

None requested

#### 1.5 BASE BID AMOUNT

- A. The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Young + Wright Architectural, and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work hereby agrees to furnish all material, labor, equipment, and services, including all scheduled allowances, necessary to complete the construction of the work for the above named Project and Bid Package, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

Base Bid: (written amount) \_\_\_\_\_

Base Bid: (numerical amount) \_\_\_\_\_

#### 1.9 NON-COLLUSIVE AFFIDAVIT

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

Being first duly sworn deposes and says that:

1. He/She is the (Owner, Partner, Officer, representative, or agent) of \_\_\_\_\_, the bidder that has submitted the attached bid.
  - a. By submission of this bid, each person signing on behalf of a bidder certifies, and in the case of a joint bid each party thereto certified as to its own organization, under penalty of perjury, that to the best of knowledge and belief.
    - 1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.
    - 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening directly or indirectly, to any other bidder or to any competitor.
    - 3) No attempt has been made or will be by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
  - b. A bid shall not be considered for award nor shall any award be made where a., 1, 2,3, above have not been complied with; provided however, that if in any case the bidder



cannot make the foregoing certification, the bidder shall so state and shall furnish, with the bid a signed statement which sets forth in detail the reason therefore. Where 1, 2 and 3, above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency of the official therefore to which the bid is made, or designee, determines that such disclosure was not made for the purpose of restricting completion.

- c. The fact that a bidder (a) has published price lists, rates or tariffs covering the items being produced, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within more, a disclosure within the meaning of subparagraph one (a).
2. Any Bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have authorized by the board of directors of the bidder and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificates as to non-collusion as the act and deed of the corporation.

Signed: \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

My commission expires: \_\_\_\_\_

Notary Public Stamp:

#### 1.6 1.10 SEXUAL HARASSMENT PREVENTION CERTIFICATION

- A. By submission of this bid, the person signing on behalf of the bidder certifies, under penalty of perjury, that the bidder has and has implemented a written policy addressing sexual harassment prevention in the workplace and provides annual sexual harassment prevention training to all of its employees. Such policy shall, at a minimum, meet the requirements of Section 201-g of the Labor Law.

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

#### 1.7 IRAN DIVESTMENT ACT CERTIFICATION

- A. As a result of the Iran Divestment Act of 2012 (Act), Chapter 1 of the 2012 Laws of New York, a new provision has been added to the State Finance Law (SFL), §165-a, effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list (prohibited entities list) of “persons” who are engaged in “investment activities in Iran” (both are defined terms in the law). Pursuant to SFL § 165-a(3)(b), the initial list is

expected to be issued no later than 120 days after the Act's effective date, at which time it will be posted on the OGS website.

By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, Bidder/Contractor (or any assignee) certifies that once the prohibited entities list is posted on the OGS website, it will not utilize on such Contract any subcontractor that is identified on the prohibited entities list.

Additionally, Bidder/Contractor is advised that once the list is posted on the OGS website, any Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to the solicitation, must certify at the time the Contract is renewed, extended or assigned that it is not included on the prohibited entities list.

During the term of the Contract, should the New York State Education Department (AGENCY) receive information that a person is in violation of the above-referenced certification, AGENCY will offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then AGENCY shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.

AGENCY reserves the right to reject any bid or request for assignment for an entity that appears on the prohibited entities list prior to the award of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the prohibited entities list after contract award.

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

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

Title: \_\_\_\_\_

Company: \_\_\_\_\_

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

#### 1.15 CERTIFICATE AS TO A CORPORATE BIDDER

Corporate Seal

Name of Corporate (Bidder): \_\_\_\_\_

Print Name of Authorized Person: \_\_\_\_\_

Signature of Authorized Person: \_\_\_\_\_

Title of Authorized Person: \_\_\_\_\_

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

1.16 DEPARTMENT OF LABOR CONTRACTOR REGISTRY CERTIFICATION  
(EFFECTIVE DECEMBER 2024)

New York Labor Law Section 220-I establishes a registration system for contractors and subcontractors involved in public work projects. This law requires contractors and subcontractors to register with the Department of Labor, providing detailed information about their business and compliance with labor laws. This registration must be completed prior to bidding on public work projects or commencing work on public work projects or covered private projects that are subject to the prevailing wage pursuant to Sections 224-a, 224-d, 224-e

No contractor shall bid on a contract for public work unless such contractor is registered pursuant to this section. In the case of a covered project subject to section two hundred twenty-four-a or two hundred twenty-four-d of this article, or other projects that are privately owned and subject to provisions of this article, contractors must register prior to commencing any work on a covered project. Subcontractors must be registered prior to commencing any work on a covered project. Further, each contractor must submit their certificate of registration at the time the bid is made. Applications for registration shall not be accepted as a substitute for a certificate of registration for the purposes of this section.

Certification below indicates that this registration has been completed prior to bidding:

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

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

Prime Contractor NYS DOL Contract Registration #: \_\_\_\_\_

END OF SECTION 004113.3

## SECTION 004113.4 – BID FORM MECHANICAL

### PART 1 - GENERAL

#### 1.1 CONTRACTOR INFORMATION

- A. Bidder's Full Name \_\_\_\_\_
1. Address \_\_\_\_\_
2. City, State, Zip \_\_\_\_\_
3. Telephone # \_\_\_\_\_
4. Email \_\_\_\_\_
5. Date \_\_\_\_\_

#### 1.2 BID BOND

- A. A Bid bond in the amount specified on the line below and as required by the "Invitation to Bid", is included with this bid form.

Bid Bond Amount: \_\_\_\_\_

#### 1.3 PROJECT SITE INSPECTION

- A. Bidder's signature on the following line indicates that a representative of the company that has been involved in the preparation of this bid, has visited the project site, is familiar with the scope of the project, and has inspected the existing conditions.

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

#### 1.4 ADDENDUMS

- A. Bidder acknowledges receipt of the following Addendums.

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

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

## 1.5 START OF WORK

- A. Bidder's signature on the following line indicates that the contractor shall proceed with work in a timely manner following receipt of written "Notice to Proceed" and in accordance with the General Conditions of the contract and the project schedule.

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

## 1.6 IMMEDIATE SUBMITTALS

- A. Bidders signature on the following line indicates that the contractor understands the requirements of Division 1 of this specification's manual including the General Conditions and will provide all requirements of such sections including insurance certificates, progress schedules, schedule of values, schedule of submittals, etc.

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

## 1.7 SCHEDULE OF UNIT PRICES

- A. The following unit prices may be used for changes to the work. Unit process shall include all labor, materials, fittings, insulation, tools, equipment, handling, storage, hoisting, distribution, protection of materials, clean up, field and office supervision, fringe benefits, overhead and profit of any kind and insurance. No further charge except the unit price shall be made for a change. The unit prices apply for the NET change in quantity for each change request issued. If Payment and Performance bonds are required, a net change percentage will be added to the net total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

### UNIT PRICE #H1

Pricing for hot water/glycol valve replacements. Scope to include piping, valve, insulation removal and replacement.

\$ \_\_\_\_\_ per 1/2" instance  
\$ \_\_\_\_\_ per 3/4" instance  
\$ \_\_\_\_\_ per 1" instance  
\$ \_\_\_\_\_ per 1-1/4" instance  
\$ \_\_\_\_\_ per 1-1/2" instance  
\$ \_\_\_\_\_ per 2" instance  
\$ \_\_\_\_\_ per 2-1/2" instance  
\$ \_\_\_\_\_ per 3" instance  
\$ \_\_\_\_\_ per 4" instance

### UNIT PRICE #H2

Pricing for steam valve replacements. Scope to include piping, valve, insulation removal and replacement.

\$ \_\_\_\_\_ per 3/4" instance  
\$ \_\_\_\_\_ per 1" instance  
\$ \_\_\_\_\_ per 1-1/4" instance  
\$ \_\_\_\_\_ per 1-1/2" instance  
\$ \_\_\_\_\_ per 2" instance

\$ \_\_\_\_\_ per 2-1/2" instance  
\$ \_\_\_\_\_ per 3" instance  
\$ \_\_\_\_\_ per 4" instance

**UNIT PRICE #H3**

Pricing for condensate return valve replacements. Scope to include piping, valve, insulation removal and replacement.

\$ \_\_\_\_\_ per 3/4" instance  
\$ \_\_\_\_\_ per 1" instance  
\$ \_\_\_\_\_ per 1-1/4" instance  
\$ \_\_\_\_\_ per 1-1/2" instance  
\$ \_\_\_\_\_ per 2" instance  
\$ \_\_\_\_\_ per 2-1/2" instance  
\$ \_\_\_\_\_ per 3" instance

**1.8 BASE BID AMOUNT**

- A. Bidder indicates that the contract documents including specifications and addenda have been carefully reviewed and proposes to furnish all labor, materials, equipment and supervision to complete the work indicated by this contract on or before the completion dates specified in the contract documents and in accordance with the General Conditions of the contract and the contract documents for the following compensation.

Base Bid: (written amount) \_\_\_\_\_

Base Bid: (numerical amount) \_\_\_\_\_

**1.9 NON-COLLUSIVE AFFIDAVIT**

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

Being first duly sworn deposes and says that:

1. He/She is the (Owner, Partner, Officer, representative, or agent) of \_\_\_\_\_, the bidder that has submitted the attached bid.
  - a. By submission of this bid, each person signing on behalf of a bidder certifies, and in the case of a joint bid each party thereto certified as to its own organization, under penalty of perjury, that to the best of knowledge and belief.
    - 1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.
    - 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not

knowingly be disclosed by the bidder prior to opening directly or indirectly, to any other bidder or to any competitor.

- 3) No attempt has been made or will be by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
- b. A bid shall not be considered for award nor shall any award be made where a., 1, 2,3, above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish, with the bid a signed statement which sets forth in detail the reason therefore. Where 1, 2 and 3, above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency of the official therefore to which the bid is made, or designee, determines that such disclosure was not made for the purpose of restricting completion.
- c. The fact that a bidder (a) has published price lists, rates or tariffs covering the items being produced, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within more, a disclosure within the meaning of subparagraph one (a).
2. Any Bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have authorized by the board of directors of the bidder and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificates as to non-collusion as the act and deed of the corporation.

Signed: \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

My commission expires: \_\_\_\_\_

Notary Public Stamp:

#### 1.10 CERTIFICATE AS TO A CORPORATE BIDDER

Corporate Seal

Name of Corporate (Bidder): \_\_\_\_\_

Print Name of Authorized Person: \_\_\_\_\_

Signature of Authorized Person: \_\_\_\_\_

Title of Authorized Person: \_\_\_\_\_

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

#### 1.11 IRAN DIVESTMENT ACT CERTIFICATION

- A. As a result of the Iran Divestment Act of 2012 (Act), Chapter 1 of the 2012 Laws of New York, a new provision has been added to the State Finance Law (SFL), § 165-a, effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list (prohibited entities list) of “persons” who are engaged in “investment activities in Iran” (both are defined terms in the law). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act’s effective date, at which time it will be posted on the OGS website.
- B. By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, Bidder/Contractor (or any assignee) certifies that once the prohibited entities list is posted on the OGS website, it will not utilize on such Contract any subcontractor that is identified on the prohibited entities list.
- C. Additionally, Bidder/Contractor is advised that once the list is posted on the OGS website, any Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to the solicitation, must certify at the time the Contract is renewed, extended or assigned that it is not included on the prohibited entities list.
- D. During the term of the Contract, should the New York State Education Department (AGENCY) receive information that a person is in violation of the above-referenced certification, AGENCY will offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then AGENCY shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.
- E. AGENCY reserves the right to reject any bid or request for assignment for an entity that appears on the prohibited entities list prior to the award of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the prohibited entities list after contract award.

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

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

Title: \_\_\_\_\_

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

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

END OF SECTION 004113.4



## SECTION 004113.5 – BID FORM PLUMBING

### PART 1 - GENERAL

#### 1.1 CONTRACTOR INFORMATION

- A. Bidder's Full Name \_\_\_\_\_
1. Address \_\_\_\_\_
2. City, State, Zip \_\_\_\_\_
3. Telephone # \_\_\_\_\_
4. Email \_\_\_\_\_
5. Date \_\_\_\_\_

#### 1.2 BID BOND

- A. A Bid bond in the amount specified on the line below and as required by the "Invitation to Bid", is included with this bid form.

Bid Bond Amount: \_\_\_\_\_

#### 1.3 PROJECT SITE INSPECTION

- A. Bidder's signature on the following line indicates that a representative of the company that has been involved in the preparation of this bid, has visited the project site, is familiar with the scope of the project, and has inspected the existing conditions.

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

#### 1.4 ADDENDUMS

- A. Bidder acknowledges receipt of the following Addendums.

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

Addendum # \_\_\_\_\_ Date: \_\_\_\_\_

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

## 1.5 START OF WORK

- A. Bidder's signature on the following line indicates that the contractor shall proceed with work in a timely manner following receipt of written "Notice to Proceed" and in accordance with the General Conditions of the contract and the project schedule.

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

## 1.6 IMMEDIATE SUBMITTALS

- A. Bidders signature on the following line indicates that the contractor understands the requirements of Division 1 of this specification's manual including the General Conditions and will provide all requirements of such sections including insurance certificates, progress schedules, schedule of values, schedule of submittals, etc.

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

## 1.7 SCHEDULE OF UNIT PRICES

- A. The following unit prices may be used for changes to the work. Unit process shall include all labor, materials, fittings, insulation, tools, equipment, handling, storage, hoisting, distribution, protection of materials, clean up, field and office supervision, fringe benefits, overhead and profit of any kind and insurance. No further charge except the unit price shall be made for a change. The unit prices apply for the NET change in quantity for each change request issued. If Payment and Performance bonds are required, a net change percentage will be added to the net total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.

### UNIT PRICE #P1

Pricing for hot water/glycol valve replacements. Scope to include piping, valve, insulation removal and replacement.

|          |                     |
|----------|---------------------|
| \$ _____ | per 1/2" instance   |
| \$ _____ | per 3/4" instance   |
| \$ _____ | per 1" instance     |
| \$ _____ | per 1-1/4" instance |
| \$ _____ | per 1-1/2" instance |
| \$ _____ | per 2" instance     |
| \$ _____ | per 2-1/2" instance |
| \$ _____ | per 3" instance     |
| \$ _____ | per 4" instance     |

### UNIT PRICE #P2

Pricing for steam valve replacements. Scope to include piping, valve, insulation removal and replacement.

|          |                     |
|----------|---------------------|
| \$ _____ | per 3/4" instance   |
| \$ _____ | per 1" instance     |
| \$ _____ | per 1-1/4" instance |
| \$ _____ | per 1-1/2" instance |
| \$ _____ | per 2" instance     |

\$ \_\_\_\_\_ per 2-1/2" instance  
\$ \_\_\_\_\_ per 3" instance  
\$ \_\_\_\_\_ per 4" instance

**UNIT PRICE #P3**

Pricing for condensate return valve replacements. Scope to include piping, valve, insulation removal and replacement.

\$ \_\_\_\_\_ per 3/4" instance  
\$ \_\_\_\_\_ per 1" instance  
\$ \_\_\_\_\_ per 1-1/4" instance  
\$ \_\_\_\_\_ per 1-1/2" instance  
\$ \_\_\_\_\_ per 2" instance  
\$ \_\_\_\_\_ per 2-1/2" instance  
\$ \_\_\_\_\_ per 3" instance

**1.8 BASE BID AMOUNT**

- A. Bidder indicates that the contract documents including specifications and addenda have been carefully reviewed and proposes to furnish all labor, materials, equipment and supervision to complete the work indicated by this contract on or before the completion dates specified in the contract documents and in accordance with the General Conditions of the contract and the contract documents for the following compensation.

Base Bid: (written amount) \_\_\_\_\_

Base Bid: (numerical amount) \_\_\_\_\_

**1.9 NON-COLLUSIVE AFFIDAVIT**

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

Being first duly sworn deposes and says that:

1. He/She is the (Owner, Partner, Officer, representative, or agent) of \_\_\_\_\_, the bidder that has submitted the attached bid.
  - a. By submission of this bid, each person signing on behalf of a bidder certifies, and in the case of a joint bid each party thereto certified as to its own organization, under penalty of perjury, that to the best of knowledge and belief.
    - 1) The prices in this bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor.
    - 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not

knowingly be disclosed by the bidder prior to opening directly or indirectly, to any other bidder or to any competitor.

- 3) No attempt has been made or will be by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
- b. A bid shall not be considered for award nor shall any award be made where a., 1, 2,3, above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish, with the bid a signed statement which sets forth in detail the reason therefore. Where 1, 2 and 3, above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency of the official therefore to which the bid is made, or designee, determines that such disclosure was not made for the purpose of restricting completion.
- c. The fact that a bidder (a) has published price lists, rates or tariffs covering the items being produced, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within more, a disclosure within the meaning of subparagraph one (a).
2. Any Bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have authorized by the board of directors of the bidder and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificates as to non-collusion as the act and deed of the corporation.

Signed: \_\_\_\_\_

Subscribed and sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

My commission expires: \_\_\_\_\_

Notary Public Stamp:

#### 1.10 CERTIFICATE AS TO A CORPORATE BIDDER

Corporate Seal

Name of Corporate (Bidder): \_\_\_\_\_

Print Name of Authorized Person: \_\_\_\_\_

Signature of Authorized Person: \_\_\_\_\_

Title of Authorized Person: \_\_\_\_\_

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

#### 1.11 IRAN DIVESTMENT ACT CERTIFICATION

- A. As a result of the Iran Divestment Act of 2012 (Act), Chapter 1 of the 2012 Laws of New York, a new provision has been added to the State Finance Law (SFL), § 165-a, effective April 12, 2012. Under the Act, the Commissioner of the Office of General Services (OGS) will be developing a list (prohibited entities list) of “persons” who are engaged in “investment activities in Iran” (both are defined terms in the law). Pursuant to SFL § 165-a(3)(b), the initial list is expected to be issued no later than 120 days after the Act’s effective date, at which time it will be posted on the OGS website.
- B. By submitting a bid in response to this solicitation or by assuming the responsibility of a Contract awarded hereunder, Bidder/Contractor (or any assignee) certifies that once the prohibited entities list is posted on the OGS website, it will not utilize on such Contract any subcontractor that is identified on the prohibited entities list.
- C. Additionally, Bidder/Contractor is advised that once the list is posted on the OGS website, any Contractor seeking to renew or extend a Contract or assume the responsibility of a Contract awarded in response to the solicitation, must certify at the time the Contract is renewed, extended or assigned that it is not included on the prohibited entities list.
- D. During the term of the Contract, should the New York State Education Department (AGENCY) receive information that a person is in violation of the above-referenced certification, AGENCY will offer the person an opportunity to respond. If the person fails to demonstrate that it has ceased its engagement in the investment which is in violation of the Act within 90 days after the determination of such violation, then AGENCY shall take such action as may be appropriate including, but not limited to, imposing sanctions, seeking compliance, recovering damages, or declaring the Contractor in default.
- E. AGENCY reserves the right to reject any bid or request for assignment for an entity that appears on the prohibited entities list prior to the award of a contract, and to pursue a responsibility review with respect to any entity that is awarded a contract and appears on the prohibited entities list after contract award.

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

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

Title: \_\_\_\_\_

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

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

END OF SECTION 004113.5

## SECTION 007200 - GENERAL CONDITIONS

### 1.1 GENERAL CONDITIONS AND SUPPLEMENTS

- A. General Conditions and Supplements shall be as included in the standard document issued by the American Institute of Architects, AIA Document A232 Version 2019, "General Conditions of the Contract for Construction," as provided on the next page of this specification section.
- B. All supplements have been added directly to the document. No additional supplementary General Conditions section will be included.

END OF SECTION 007200

# AIA<sup>®</sup> Document A232<sup>®</sup> – 2019

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

### **for the following PROJECT:**

*(Name, and location or address)*

#### **Lake Shore Central School District Capital Improvement Project 2023 – Phase 3**

SED #14-14-01-06-0-001-024

High School  
959 Beach Road, Angola, NY 14006

### **THE CONSTRUCTION MANAGER:**

*(Name, legal status, and address)*

#### **Campus Construction Management Group, Inc.**

6225 Sheridan Drive, Suite 100  
Williamsville, New York, 14221  
Telephone Number: (716) 239-4884

### **THE OWNER:**

*(Name, legal status, and address)*

#### **Lake Shore Central School District**

959 Beach Road  
Angola, New York 14006  
Tel: 716-926-2201

### **THE ARCHITECT:**

*(Name, legal status, and address)*

#### **Young Architectural, LLC dba Young + Wright Architectural**

50 Elk Street, Suite 200  
Buffalo, New York 14210  
Tel: 716-842-1800

### **ADDITIONS AND DELETIONS:**

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

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

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

**§ 1.1.1 The Contract Documents.** The Contract Documents comprise (1) the Agreement between the Owner and Contractor ("Agreement"), (2) Advertisement for Bids, (3) Instructions to Bidders, (4) these General Conditions, (5) Supplementary or other Conditions, if any, (6) Drawings, (7) Specifications, (8) Addenda issued prior to receipt of bids, (9) The Contractor's Bid, (10) Modifications issued after execution of the Agreement, (11) the Contractor's Performance and Payment Bonds, (12) other documents listed in the Agreement, if any. A Modification is (1) a written amendment to the Contract Documents 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. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents.

**§ 1.1.2 The Contract.** The Contract Documents form the Contract for Construction ("Contract"). The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor (except in the event the Owner accepts an assignment under Section 5.4) or Sub-subcontractor, (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect are, however, entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

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

**§ 1.1.4 The Project.** The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors, and by the Owner's own forces and Separate Contractors.

**§ 1.1.5 Contractors.** Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager.

**§ 1.1.6 Separate Contractors.** Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

**§ 1.1.7 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.

**§ 1.1.8 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.

**§ 1.1.9 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.

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

#### **§ 1.1.11 MISCELLANEOUS DEFINITIONS**

**§ 1.1.11.1** The term "product" as used herein includes materials, systems and equipment.

**§ 1.1.11.2** The word "Provide" is used herein as a term contraction and unless otherwise specifically noted is to mean "furnish, install, connect up complete, test, place in operation and service."

**§ 1.1.11.3** "Approved," "approved equal," "approved equivalent," "equal to," "equivalent to," "as directed," and "as required" all include "to the satisfaction of the Architect and Construction Manager."

**§ 1.1.11.4** "Remove" means "dismantle and take away from premises without added cost to Owner."

**§ 1.1.11.5** "Supply" means "purchase and deliver to jobsite."

**§ 1.1.11.6** The terms "install" or "furnish all labor" are used herein as term contractions and unless specifically noted otherwise are to mean "perform" all operations connected with installation of work including unloading materials to be installed, supplying all necessary equipment and rigs to do the work, test, place in operation and service.

**§ 1.1.11.7** "Extract" means "carefully dismantle and store where directed by Architect or reinstall as indicated on drawings or as described in the Specifications."

**§ 1.1.11.8** "Review" and "reviewed" include the qualification "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents."

**§ 1.1.11.9** The terms "Furnish" or "Furnish all material" are used herein as term contractions and unless specifically noted otherwise are to mean "supply and deliver to the job site all materials and/or equipment so specified."

**§ 1.1.11.10** The word "Replace" is used herein as a term contraction and unless otherwise specifically noted is to mean "remove existing and provide new."

#### **§ 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 must be consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe work, materials, or equipment, such words or phrases shall be interpreted in accordance with the meaning. Even if items are missing from the Drawings or Specifications, but are normally required for proper operation of architectural, plumbing, mechanical, electrical, and other systems, or to complete otherwise incomplete construction, or to meet governing code requirements, they must be included by the Contractor, unless the Contractor sought and received contradictory interpretation or clarification from the Architect.

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

**§ 1.2.1.2** The Contractor and its Subcontractors shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including without limitation (1) location, layout, and nature of the Project site and surrounding areas, (2) existing building and site conditions, (3) anticipated labor supply and costs,

(4) availability and cost of materials, tools, equipment, (5) Owner occupancy requirements and constraints, (6) site safety logistics plan and any phased construction plan and (7) other similar issues. The Owner assumes no responsibility or liability for the physical condition or safety of the Project site, or any improvements located on the Project site. The Contractor shall be sole responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time in connection with any failure by Contractor or any Subcontractor to comply with the requirements of this Section 1.2.1.2.

**§ 1.2.2** Organization of the Specifications into divisions, sections, and articles, and arrangement of Drawings do not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Instructions and other information furnished in the Specifications, including, without limitation items in connection with prefabricated or pre-finished items, are not intended to supersede work agreements between employers and employees. Should the Specifications conflict with such work agreements, the work agreements must be followed, provided such items are furnished as specified. No such conflict gives rise to an adjustment in the Contract Sum or Contract Time.

**§ 1.2.2.1** The Work on the Project will be separated into individual and separate contracts. It is the intent of these requirements to include all items of Work for a complete Project in the separate contracts. Each Contractor shall be responsible for understanding and knowing under which contract each item of Work is included.

**§ 1.2.2.2** Each section or division of the Specifications has been assigned to one of the contract scopes. Where a section of the Specification is referenced in the contract scope, then any and all items necessary for the proper and normal installation of the item referenced in the Specification section shall be included whether specifically indicated in the Contract Documents or not.

**§ 1.2.2.3** The reference of the "Specifications" regarding the division or separation of the work among types of trades or occupations is only for the suggested purpose of coordinating the work of the different trades, but it shall be the Contractor's entire responsibility for the proper coordination and completion of all the Work described in the "Specifications" whether performed by the Contractor or its Subcontractors, if any.

**§ 1.2.2.4** The Contractor acknowledges that the coordination requirements and construction schedule of this Project will require close cooperation and coordination between all Contractors on the Project site.

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

**§ 1.2.3.1** In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities, from highest to lowest:

- .1 Change Orders.
- .2 Agreement.
- .3 Addenda, with those of later date having precedence over those of earlier date.
- .4 Supplementary, Special, or other Conditions, other than the General Conditions, as may be part of the Contract Documents.
- .5 General Conditions of the Contract for Construction.
- .6 Specifications.
- .7 Drawings

In case of an inconsistency between Drawings and Specifications or within other Documents not clarified by addendum the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation. The Architect's determination shall be final.

**§ 1.2.4** Notwithstanding Section 1.2.3.1, in the case of any inconsistency with respect to the quality or quantity of Work required by the Project Manual, Drawings and/or Specifications, or within any of these documents, which have not been clarified by addenda, the higher quality standard and/or greater quantity of Work must be provided, unless the Architect decides another interpretation is more consistent with the intent of the Project and issues a written clarification to that effect. The Architect's interpretations and decisions with respect to these issues are final.

**§ 1.2.5** The Contract Drawings are intended to show the general arrangement, design, and extent of the Work and are partly diagrammatic. They are not intended to be scaled for any purpose, or to serve as shop drawings. All Contractors

and Subcontractors shall cooperate in determining the construction of systems, running of pipe, and locating equipment.

**§ 1.2.5.1** Any necessary variations in routing or installation must be made to conform to the intent of the Contract Documents without additional costs to the Owner. Where there are intersections or obstructions involving ducts, piping, or any other equipment requiring offsets, the Contractor acknowledges that it gave particular consideration to clearances in advance of submitting its bid, and that no additional costs to the Owner for these issues will be considered.

**§ 1.2.5.2** If conflicting conditions or interferences develop, the trades involved shall confer with other trades whose work is affected to determine a solution acceptable to all interested parties. The suggested solution must be submitted to the Architect and Construction Manager for comment and, if necessary, written approval.

**§ 1.2.5.3** The Contractor agrees that the failure to repeat typical details, figures, or notes on all Contract Drawings or in other Contract Documents is not a basis for claims for additional cost or time.

**§ 1.2.6** The Contract Documents intend a finished product of such character and quality as described in and reasonably inferred from the Contract Documents, and the Contractor shall include sufficient allowance to make its Work complete and operable, fitting with the work of other contractors and the Owner, and in compliance with standard construction practices and the ordinances, codes, and regulations of all bodies or persons having governmental or regulatory authority over the Contractor and its Work.

**§ 1.2.7** Certain portions of the Specifications are written in condensed outline form and omitted words are to be supplied by inference. Naming of an article or operation shall have the effect of stating "Contractor shall furnish, install and complete" said operation or article unless it is further qualified in the context in which it appears.

**§ 1.2.8** When reference is made to specifications of a manufacturer, trade association, governmental agency, reference standard or similar source (such as ASTM, ASA, AISC, ACI, etc.) such is made part of these specifications, having the force and effect as though reproduced herein, and upon entering into the Contract the Contractor acknowledges his familiarity with those pertaining to his work.

### **§ 1.3 Capitalization**

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

### **§ 1.4 Interpretation**

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

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

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

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

**§ 1.5.3** The Contractor may not reproduce the Contract Documents in whole or in part for use as a shop drawing backgrounds without the prior written consent of the Architect. If consent is given, the Architect shall determine the

extent that the Contract Documents may be used in the preparation of shop drawings, as well as the fee that the Architect will be paid, if any and in the Architect's sole discretion, by the Contractor for such use of copyrighted documents.

#### **§ 1.6 Notice**

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

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

#### **§ 1.7 Digital Data Use and Transmission**

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

#### **§ 1.8 Building Information Models Use and Reliance**

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

### **ARTICLE 2 OWNER**

#### **§ 2.1 General**

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The Construction Manager is the Owner's representative with authority to act on behalf of the Owner but only to the extent provided for in the Agreement between the Construction Manager and the Owner.

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

**§ 2.1.3** The Owner, Construction Manager, and Architect shall not supervise, direct or have control of authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction of the safety precautions and programs incident, or for any failure of Contractor to comply with Laws and Regulations applicable to the furnishing or performance of the work. Owner, Construction Manager, and Architect will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

**§ 2.1.4** The Owner shall have the right to contract with other contractors to perform other work related to the Project. The Contractor will coordinate its Work with the work of other contractors without claims for damages or delay in prosecution of the Contractor's Work.

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

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

**§ 2.2.2** Not used.

**§ 2.2.3** Not used.

**§ 2.2.4** Not used.

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

**§ 2.3.1** All permits and fees, approvals, easements, assessments and charges required for construction, use or occupancy of the permanent structures or for permanent changes in the existing facilities are the responsibility of the Contractor under the Contract Documents with the exception of the building permit, which the Owner will obtain from the New York State Education.

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

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

**§ 2.3.4** Not used.

**§ 2.3.5** 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. Notwithstanding the foregoing, information furnished by the Owner in the form of surveys, subsurface investigation reports, soil borings, and other material of a similar nature, is for general information only and is not a guarantee of the completeness or accuracy of such information, unless specifically noted otherwise in the Contract Documents. The Contractor shall verify all existing grades, conditions, and dimensions of existing physical conditions and structures and shall report any inconsistencies in writing to the Architect and Construction Manager. The Contractor shall establish all lines and levels required to execute the Work and shall bear all costs involved and shall be responsible for their accuracy and maintenance.

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

**§ 2.3.7** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor (1) one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

**§ 2.3.8** The Owner shall forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

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

If the Contractor (1) fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or (2) fails to carry out Work in accordance with the Contract Documents as determined by the Owner, Architect or Construction Manager, or (3) fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials or equipment so as to be able to complete the Work within the Contract Time, or (4) fails to remove and discharge (within seven (7) days) any lien filed upon Owner's property by anyone claiming by, through, or under Contractor, (5) disregards the instructions of the Architect, Owner or Construction

Manager, 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 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. Such order or stoppage by the Owner shall not constitute grounds for termination by the Contractor under Article 14 and shall not be a basis for an extension of the Contract Time under Section 8.3.

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

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a (3) three-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to review by the Construction Manager and prior approval of the Architect, and the Construction Manager or Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 General**

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

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

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

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

**§ 3.2.1** Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with visually observable conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents. The Contractor and each Subcontractor shall evaluate and satisfy themselves as to the conditions and limitations under which the Work is to be performed, including without limitation (1) the location, condition, layout and nature of the Project site and surrounding areas, (2) generally prevailing climactic conditions, (3) anticipated labor supply and costs, and (4) availability and cost of materials, tools, and equipment. Except for paying the Contract Sum, the Owner assumes no responsibility or liability for the physical condition or safety of the Project site, or any improvements located on the Project site. The Contractor is solely responsible for providing a safe place for the performance of the Work. The Owner is not required to make any adjustment in either the Contract Sum or the Contract Time in connection with any failure by the Contractor or any Subcontractor to comply with the requirements of this Section 3.2.1.

**§ 3.2.1.1** The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.2.3 and shall at once report in writing to the Construction Manager and Architect errors, inconsistencies or omissions discovered. The Contractor will not be liable to the Owner, Construction Manager or Architect for damage resulting from errors, inconsistencies, or omissions in the Contract Documents unless the Contractor knew or reasonably should have known of such error, inconsistency or omission and failed to report it as required by this section to the Construction Manager and Architect. If the Contractor performs any construction activity knowing it involves, or reasonably should have known it involves, a recognized error, inconsistency, or omission in the Contract Documents without such notice to the Construction Manager and Architect, the Contractor shall assume full responsibility for such performance and shall bear sole responsibility for the costs for correction.

**§ 3.2.2** The Contractor shall, before starting each portion of the Work, (1) 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, (2) take field measurements of any existing conditions related to that portion of the Work, and (3) observe any conditions at the site affecting it. The Contractor shall promptly report to the Architect and the Construction Manager any errors, inconsistencies or omissions, or any discrepancy with applicable laws, statutes, ordinances, codes, rules, regulations, or lawful orders of public authorities ascertained by, discovered by, or made known to the Contractor, as a Request for Information ("RFI") in such form as the Architect may require and as described in Section 3.2.6. 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** Failure by the Contractor to promptly report any errors, inconsistencies, or omissions in the Contract Documents, or any discrepancy with applicable laws, statutes, ordinances, codes, rules, and regulations, or lawful orders of public authorities, ascertained by, discovered by, or made known to the Contractor, or which the Contractor reasonably should have known, constitutes a waiver by the Contractor of any claim that otherwise might result in a change in the Contract Sum or Contract Time.

**§ 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 is not 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, regulations, and lawful orders of public authorities.

**§ 3.2.5** The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect and Construction Manager at once. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contractors, is not guaranteed by the Architect or Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the site all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to so verify grades, elevations, dimensions, or locations must be promptly rectified by the Contractor without any additional cost to the Owner.

**§ 3.2.6 Requests for Information.** The Contractor may submit RFIs to the Architect and Construction Manager to help facilitate the Contractor's performance of the work. Prior to submitting each RFI, the Contractor shall first carefully study and compare the Contract Documents, field conditions, other Owner provided information, Contractor prepared Coordination Drawings, and prior Project correspondence and documentation to determine that the information to be requested is not reasonably obtainable from such sources. The Contractor shall submit each RFI sufficiently in advance of the date by which such information is required in order to allow the Architect and Construction Manager sufficient time to permit adequate review and response and to permit Contractor compliance with the latest construction schedule. The Contractor shall reimburse the Owner amounts charged by the Architect or Construction Manager for RFI responses that in the opinion of the Architect and Construction Manager were available from a careful review of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared Coordination Drawings, and prior Project correspondence and documentation.

**§ 3.2.7** The location of existing features shown on plans is intended for general information only. The Contractor, alone, is responsible for accurate determination of the location of all structures and is not entitled to any extra payment due to any unforeseen difficulties or distances encountered in the Work.

**§ 3.2.8 Underground Conditions.** The locations, depths, and data as to underground conditions were obtained from records, surface indications, and data furnished by others. Information furnished is solely for the convenience of the



Contractor without any warranty, express or implied, as to its accuracy or completeness. The Contractor cannot make a Claim with respect to the accuracy or completeness of such information if it is erroneous, or if the conditions found at the time of construction are different from those as indicated, unless the conditions constitute a material difference under Section 3.2.11.

**§ 3.2.9 Construction Stresses.** The Contractor is solely responsible for conditions that develop during construction and in the event any structure is dislocated, overstrained, or damaged so as to affect its usefulness, the Contractor is solely responsible. The Contractor shall take whatever steps necessary to strengthen, relocate, or rebuild the structure to meet requirements of the Contract Documents.

**§ 3.2.10 Restoration and Repair of Damaged Property.** The Contractor is responsible for restoration and/or repair of utilities, private property, buildings, pavement, walkways, roads, or other property damaged by its activities under the Contract Documents.

**§ 3.2.11** Not used.

**§ 3.2.12** Not used.

**§ 3.2.13** Whenever the Drawings show existing or other construction not required as part of the Contract Work, it is understood that it is so shown as a matter of information and that the Owner, and Architect, while believing such information to be substantially correct, assumes no responsibility thereof.

**§ 3.2.14** If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume full responsibility for such performance and shall bear full responsibility for the attributable costs for correction.

### **§ 3.3 Supervision and Construction Procedures**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instruction concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety as to such instructions and, except as stated below, is 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, the Construction Manager, and the Architect with specific objections and proposed changes, 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 or reaching agreement with the Architect as to resolution of the safety issues, the Contractor is not responsible for any loss or damage relating to safety arising solely from the required means, methods, techniques, sequences, or procedures to which the Contractor objected.

**§ 3.3.1.1** The Contractor's obligations under the Contract Documents include, without limitation:

- .1** Review of all specified construction and installation procedures, including, without limitation, those recommended by manufacturers.
- .2** Advising the Construction Manager and Architect:
  - .1** if a specified procedure deviates from standard construction practice;
  - .2** if following a procedure will affect any warranties, including the Contractor's general warranty; or
  - .3** of any objections the Contractor may have to a procedure;
- .3** Proposing alternative procedures, as appropriate, which procedures shall be covered by the Contractor's warranty in Section 3.5; and
- .4** Organizing and conducting pre-installation meetings, coordinated with the Architect and Construction Manager.

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

**§ 3.3.4** Where equipment lines, piping, ductwork, and/or conduit are shown diagrammatically, the Contractor is responsible for the coordination and orderly arrangement of the various lines of piping and conduit included in the Work of its Contract. The Contractor shall coordinate the work of its Subcontractors and prevent all interferences between or among equipment, lines of piping, and architectural features, and avoid any unsightly arrangements in exposed areas. This section shall not be construed as limiting any obligation of the Contractor under any other provision of the Contract Documents.

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

**§ 3.3.6** The Contractor, his employees and Subcontractors shall be subject to such rules and regulations for the conduct of the Work as the Owner may establish. The Contractor shall be responsible for the enforcement among his employees of the Owner's requirements.

#### **§ 3.4 Labor and Materials**

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

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

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

**§ 3.4.3.1** Persons whose work is unsatisfactory to the Owner or Architect, or who is reasonably considered by them to be unskilled or otherwise objectionable, may be immediately dismissed from the Project site upon notice to the Contractor. Any persons so dismissed shall be immediately replaced by the Contractor so as not to delay the progress of the Work.

#### **§ 3.5 Warranty**

**§ 3.5.1** The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents specifically 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 will 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 by persons other than the Contractor or its Subcontractors, improper operation by persons other than the Contractor or its Subcontractors, 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 provided for the Work. The Contractor, at its expense, shall remove and replace materials not meeting specifications or failing to meet warranties by manufacturers, regardless of whether incorporated into the Work. The Contractor shall promptly replace or correct any of the Work the Architect rejects as failing to conform to the requirements of the Contract Documents. The foregoing warranty obligations are not limited by the provisions of Article 12 and are in addition to and not in limitation of any other warranty set forth in the Contract Documents or required by law. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of Owner. If required by Architect, Contractor shall furnish satisfactory evidence (including reports of required tests) as to be the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected,

erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

**§ 3.5.2** The Contractor shall perform all warranty obligations and responsibilities for the Work under the Contract Documents. Upon completion of the Work, the Contractor shall assign and provide to the Owner all written warranties and guarantees from Subcontractors, suppliers, and material or equipment manufacturers. The Contractor shall fully cooperate with the Owner in the event the Owner pursues remedies under any warranties or guarantees assigned to the Owner. The Contractor acknowledges that its obligations to the Owner under this Section 3.5.2 are joint and several during the Warranty Period with its Subcontractors, suppliers, vendors and manufacturers of all materials and equipment supplied on account of the Work. Any notice given to the Contractor by the Owner, Architect, or Construction Manager regarding any deficiency in the Work covered by this Section 3.5 and Article 12 will toll the corrections period under Article 12 until all corrections or remedial actions necessary are taken with respect to such deficiency. The Contractor is responsible for all harm caused by its failure to maintain equipment and materials installed through the Contractor's completion of its Work. The requirements of this Section 3.5 will continue notwithstanding termination of the Contractor for any reason. The foregoing warranty obligations are not limited by the provisions of Article 12 and are in addition to and not in limitation of any other warranty set forth in the Contract Documents or required by law.

**§ 3.5.3** No warranties or guarantees by the Contractor will deprive the Owner of any cause of action, right, or remedy otherwise available for breach of any of the provisions of the Contract Documents, nor do any corrections period limit the time in which the Owner may pursue any such action, right, or remedy.

**§ 3.5.4** Contractor shall be responsible for all maintenance of the Work through Substantial Completion or assignment of applicable warranties, whichever is later.

**§ 3.5.5** Neither final payment nor any provision in Contract Documents nor partial or entire occupancy of premises by Owner shall constitute an acceptance of work not done in accordance with Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship.

**§ 3.5.6** In emergencies occurring during the guarantee period, the Owner may correct any defect immediately and charge the cost to the Contractor. The Owner shall at once notify the Contractor, who may take over the Work and make any corrections remaining after his forces arrive at the Work.

**§ 3.5.7** The Contractor shall obtain and furnish to the Architect written Manufacturer's Warranties for all major materials, systems and equipment. The terms of the warranty shall be as individually specified in the Contract Documents for the item; if no term is specified, the terms shall be a minimum of one (1) year, but not less than the standard period of the Manufacturer's Warranty for the item.

### **§ 3.6 Taxes**

**§ 3.6.1** The Owner is exempt from payment of federal, state, and local taxes, and from payment of sales and compensating use taxes of the State of New York and its cities and counties on all materials and supplies sold to the Owner pursuant to the provisions of the Contract, and the Contractor warrants and represents that these taxes were not included in the amount of its bid or the Contract Sum. This exemption does not, however, apply to tools, machinery, equipment, or other property purchased or leased by or to the Contractor or a Subcontractor. The Contractor and its Subcontractors are responsible for any and all applicable taxes, including sales and compensating use taxes, on such purchased or leased tools, machinery, equipment or other property, and the Contractor warrants and represents that such taxes were included in the amount of its bid and the Contract Sum.

**§ 3.6.2** The Contractor accepts full and exclusive liability for payment of any and all contributions, assessments, or taxes now or hereafter imposed by the Government of the United States, and/or by any city, town, village, other municipality, county, or state, that are measured by salaries, wages, or other remuneration of employees of the Contractor, Subcontractors, and Sub-subcontractors for performance of the Work.

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

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Owner, assisted by the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses, and

inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

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

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

**§ 3.7.4 Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and Construction Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may submit a Claim as provided in Article 15. No adjustment in the Contract Time or Contract Sum will occur, however, in connection with a concealed or unknown condition that does not differ materially from those conditions disclosed in the Contract Documents or that reasonably should have been disclosed by the Contractor's (1) prior inspections, tests, and reviews, or (2) inspections, tests, and reviews the Contract had the opportunity to make or should have performed in connection with the Project.

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

## **§ 3.8 Allowances**

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

**§ 3.8.2** Unless otherwise provided in the Contract Documents:

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .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 project manager and superintendent and necessary assistants who shall be in attendance at the Project site at all times during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent are as binding as if given to the Contractor. The Contractor's project manager and superintendent shall attend all project meetings, regardless of whether held prior to or following Substantial Completion of the Work.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect, through the Construction Manager, the name and qualifications of its proposed superintendent. The Construction Manager will reply within fourteen (14) days to the Contractor in writing stating (1) whether the Owner, the Construction Manager, or the Architect has reasonable objection to the proposed superintendent, or (2) that any of them require additional time to review the qualifications. Failure of the Construction Manager to reply either way within the 14-day period constitutes notice of no reasonable objection. The Contractor shall not change the Project Manager during the course of construction without prior written notification to the Architect and Owner at least 30 days prior to the proposed date of change.

**§ 3.9.3** The Contractor shall not employ a proposed project manager or superintendent to whom the Owner, Construction Manager, or Architect makes reasonable and timely objection.

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

**§ 3.10.1** The Contractor, promptly, but in no event later than fifteen (15) working days, after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project schedule to the extent required by the Contract Documents and shall provide for expeditious and practicable execution of the Work. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

**§ 3.10.1.1** The Work must be performed continuously and without interruption, in accordance with the approved construction schedule, so that all Work can be completed in the time set forth in the Contract Documents.

**§ 3.10.1.2** The sequence of the Work must be scheduled with the Owner so as to minimize interference with the Owner's use of existing structures, and the Owner's approval must be obtained in writing prior to starting of the Work.

**§ 3.10.1.3** All Work must be completed on or before the dates established in the Contract Documents and in accordance with the approved construction schedule.

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

**§ 3.10.3** The Contractor shall prepare a construction schedule comprising a schedule as described in Section 3.10.3.1. The Contractor must provide copies of all electronic schedule documents to the Construction Manager for review. The schedule must contain time-scaled logic diagrams and all other data specified in Section 3.10.3.1. The diagrams must show activities of the Project in detail and in summary format. The diagrams must also show the order and interdependence of activities and the sequence in which the Work will be accomplished, incorporating the schedule summary activities and milestone dates indicated, and as further planned by the Contractor. All logical relationships must be identified. The use of imposed start dates will also be limited. The retained logic mode must be used for calculations. The construction schedule must be provided within fifteen (15) days of the date of the Notice to Proceed.

§ 3.10.3.1 In addition to construction activities, the schedule must include, without limitation:

- .1 Testing activities/required inspections (where applicable).
- .2 Subcontractor selections and approvals (proposed major subcontractors to be submitted within 48 hours following the date of opening of the Contractor's bid to the Owner).
- .3 Shop drawing preparation and approval activities. Contractor must sequence submissions to provide sufficient time for the coordination of shop drawings of one trade that impact other trades, mock-ups, and pre-installation meetings.
- .4 Procurement schedule (order dates, fabrication, deliveries, and long lead items).
- .5 Requirements for any on-site shutdowns that may impact work.
- .6 Training and/or instruction of Owner personnel.

§ 3.10.3.2 The Contractor shall participate with other Contractors, the Construction Manager, and the Owner in producing and coordinating all schedules for incorporation into the overall Project schedule assembled by the Construction Manager. The Contractor shall make revisions to its construction schedule and its submittal schedule as deemed necessary by the Construction Manager and Architect to conform to the Project schedule.

§ 3.10.4 In the event the Owner determines that the performance of Work has not progressed to the level of completion required of the Contract Documents or that the Contractor has failed to maintain the construction schedule, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction including without limitations, additional shifts, overtime, additional manpower or equipment as well as other similar measures (hereinafter referred to collectively as "extraordinary measures"). Such extraordinary measures shall continue until the progress of Work complies with milestone dates set forth in the Contract Documents and the Project schedule. The Contractor shall not be entitled to an adjustment in Contract Sum or Contract Time in connection with extraordinary measures required by the Owner.

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

§ 3.10.6 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project schedule. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and Project schedule and shall promptly advise the Owner of any delays or potential delays.

§ 3.10.7 The Owner reserves the right to withhold payment until such time as the Contractor submits a recovery plan and daily schedule to complete all necessary (including, as necessary, acceleration of the Work by means of overtime, additional crews, additional shifts, additional equipment and/or re-sequencing of the Work) to achieve completion of the remaining milestone dates in the construction schedule and Project schedule. The cost of preparing and performing the recovery schedule shall be borne solely by the Contractor.

### § 3.11 Documents and Samples at the Site

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

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

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

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

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

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been reviewed and approved by the Architect. Resubmission of rejected documents shall be performed with 10 calendar days, or sooner if required by the progress of construction. No claim for delay or cost shall be accepted as a result of rejected submittal documents. If the Architect is required to review the Contractor's submittal more than twice, the Contractor shall bear the cost and expense associated with such additional review as set forth in the project Manual.

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

§ 3.12.8.1 Contractor's Expense: All data to be provided by Contractor in support of any proposed "or-equal" or substitute item will be at Contractor's expense.

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

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

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

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

### **§ 3.13 Use of Site**

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

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

**§ 3.13.3** Only materials and equipment to be used directly in the Work may be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it must be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work must be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work are free from all debris, building materials, and equipment likely to cause hazardous conditions.

### **§ 3.14 Cutting and Patching**

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

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

### **§ 3.15 Cleaning Up**

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials 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, and shall remove all Work-related stains, spots, marks, dirt, mortar smears, plaster smears, paint smears, caulking smears, and other foreign materials from exposed surfaces, leaving no residue or evidence of such foreign materials on the exposed surfaces.



**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor for such work.

### **§ 3.16 Access to Work**

The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located. Federal, state, and local governmental agencies with jurisdiction over the Project must at all times have access to the Work for their official functions wherever it is in preparation or progress.

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

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

### **§ 3.18 Indemnification**

**§ 3.18.1 Personal Injury and Property Damage.** To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, and their respective directors, trustees, officers, employees, agents, consultants, interim administrators, authorized volunteers and committee members, student, teachers, auxiliary instructors, and members of the Board of Education (collectively "Indemnitees") 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, when 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, and including loss of use), but only to the extent caused, in whole or part, by the acts or omissions, or other culpable conduct, 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 an Indemnitee.

The Contractor agrees to include the following indemnity provision in each and every contract it enters into with a subcontractor, and to require that subcontractor to include such provision in each contract it enters into with any lower tier subcontractor: "To the fullest extent permitted by law, Subcontractor shall indemnify and hold harmless the Contractor, Owner, Construction Manager, Architect, and each of their respective representatives, employees, directors, officers, consultants and agents, from and against any and all claims, suits, actions, debts, damages, fines, penalties, costs, charges and expenses, including attorneys' fees and court costs, arising out of, relating to or resulting from the performance of this Subcontract, including, but not limited to, bodily injury and/or property damage, to the extent caused, in whole or in part, by acts, actions, omissions, fault or breach of the Subcontractor, its employees, agents, subcontractors, suppliers and/or materialmen, regardless of whether or not such claim is caused in part by a party indemnified hereunder."

**§ 3.18.2 Employee Personal Injuries.** In claims against any Indemnitee 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 is not limited by a limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

**§ 3.18.3 Claims by Governmental Authorities.** To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against claims, damages, losses, and expenses arising out of any claims made against the Indemnitees under the laws of federal, state, or other governmental bodies having jurisdiction over the Work, including but not limited to claims arising from violation of public ordinances and other requirements of governing authorities, due to the Contractor's method of execution of the Work or implementation of any of the Contractor's other obligations under the Contract Documents.

**§ 3.18.4 Liens and Security Interests.** To the fullest extent permitted by law, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any actions, lawsuits, or other proceedings brought against Indemnitees as a result of liens or security interests of any type arising from the Work and filed against the Work, the site of any of the Work, the Project site and any improvements thereon, payments due the Contractor, or any property of any of the Indemnitees.

**§ 3.18.5 Intellectual Property.** The Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any claims or demands for patent fees, copyright fees, license fees, royalties, damages from infringements, or injunctive relief on account of legal protection of any invention, machine, article, process, patent, copyright, design, or product used by the Contractor in performing the Work, unless such use is required by the Contract Documents or where alleged violations are contained in Drawings, Specifications, or other documents prepared by the Architect. In the event of any injunction or legal action regarding such claims or demands result in stopping the Work in whole or part, the Owner has the right to direct the Contractor to change the manner of performance of the Work to avoid such stoppage, all costs and expenses occasioned by such direction shall be borne solely by the Contractor, unless the work stoppage results solely from the Contractor employing a use required by the Contract Documents or when alleged violations are contained in Drawings, Specifications, or other documents prepared by the Architect. However, if the Contractor, prior to any such claims or demands, has reason to believe that a required use infringes a copyright, patent, or other legal protection, the Contractor must promptly so advise the Architect and Construction Manager, and in the absence of such advice will be liable to the Owner to the extent such advice would have prevented additional costs to the Owner arising from such claims or demands.

**§ 3.18.6 Other Claims.** For any claims not specifically identified elsewhere in this Section 3.18, the Contractor shall defend, indemnify, and hold harmless the Indemnitees from and against any and all liability, claims, damages, losses, suits, demands, costs, charges, attorney's fees, and expenses of whatever kind or nature that the Indemnitees may directly or indirectly incur, suffer, or be required to pay by reason of, or in consequence of, the intentional conduct, negligent acts or omissions, breach of contract, or other fault of the Contractor or its Subcontractors.

**§ 3.18.7 Enforcement Costs.** The Contractor shall further indemnify and hold harmless the Indemnitees from and against any costs and expenses (including reasonable attorneys' fees) incurred by any of the Indemnitees in enforcing any of the Contractor's defense, indemnity, and hold harmless obligations under this Section 3.18 or as may otherwise be provided elsewhere in the Contract Documents.

**§ 3.18.8 Full Defense.** Subject to Section 3.18.9, all obligations of the Contractor under this Section 3.18 to defend the Indemnitees are obligations to provide full defenses at the sole cost and expense of the Contractor, regardless of any alleged culpability on the part of any Indemnitee or any ultimate determination of relative shares of liability of any Indemnitee and the Contractor.

**§ 3.18.9 Conformance to Law.** To the extent any defense, indemnity, or hold harmless obligations under this Section 3.18 are made void or otherwise impaired by any law controlling their construction (including but not limited to laws limiting such obligations to the extent of the portion of damages caused by an indemnitor), such obligations are deemed to conform to the greatest rights to defense and indemnity permitted by such law, including but not limited to New York State General Obligations Law Section 5-322.1.

**§ 3.18.10 Survival and Other Bases for Defense and Indemnity Obligations.** All provisions of this Section 3.18 will survive termination of the Agreement for any reason, or Final Completion. No obligations under this Section 3.18 negate, abridge, or reduce other rights or obligations to defense and indemnity, including but not limited to common law indemnity, that exist as to a party or person described in this Section 3.18.

**§ 3.18.11 Other Contractors and Subcontractors.** The Owner is not liable to the Contractor or any Subcontractor for damages caused by any breach of contract, delay in performance, intentional conduct, negligence, act, or omission by other contractors or subcontractors with contracts for performance of any portion of the Work on the Project, and the Contractor waives all claims for such damages.

## **§ 3.22 PHOTO ID**

**§ 3.22.1** The Contractor shall provide reasonable and visible photographic identification for each employee, subcontractor, or other person at the Project site, and shall, upon request of the Owner, make available a list of names of those employees, subcontractors, or others working under the direction of the contractor at the Project site. Any

such identification shall be reasonably visible to the Architect and to Owner's personnel at all times to allow the Owner to maintain the safety and security of Owner's buildings, property and persons under its control. Contractors failing to abide by this requirement shall be prohibited from working at the site and shall be responsible for any consequent delays or added costs to the owner as result of such noncompliance.

#### **ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER**

##### **§ 4.1 General**

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

**§ 4.1.2** The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

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

##### **§ 4.2 Administration of the Contract**

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

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner and Construction Manager known deviations from the Contract Documents and defects and deficiencies observed in the Work.

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

**§ 4.2.4** The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project schedule. Upon issuance of the Project construction schedule, each Contractor will assume full responsibility for the execution of their Work in the allotted duration times.

**§ 4.2.5** The Construction Manager, except to the extent required by Section 4.2.4, and 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, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of, or be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

**§ 4.2.6 Communications.** The Owner shall communicate with the Contractor and the Construction Manager's consultants through the Construction Manager about matters arising out of or relating to the Contract Documents. The Owner and Construction Manager shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Construction Manager otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with other Contractors shall be

through the Construction Manager. Communications by and with the Owner's own forces and Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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

**§ 4.2.8** The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents, and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

**§ 4.2.9** Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

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

**§ 4.2.11** The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

**§ 4.2.12** Review of the Contractor's submittals by the Construction Manager and Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or 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.

**§ 4.2.13** The Construction Manager will prepare Change Orders and Construction Change Directives.

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

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

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

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

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

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

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

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

## **ARTICLE 5 SUBCONTRACTORS**

### **§ 5.1 Definitions**

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

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

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

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

§ 5.2.1.1 Time is of the essence for this Project and under the Contract. Prime Contractors shall award subcontracts to entities capable of maintaining the Project schedule.

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

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. No increase in the Contract Sum or Contract Time is allowed as a result of objection to any proposed person or entity. The Owner and Architect reserve the right to contact the proposed persons or entities after award of contract as required to expedite the project.

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

### § 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, that the Contractor, by these Contract Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract 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; 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 assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site

under terms and conditions identical or substantially similar to those governing the Contract Documents, including those portions related to insurance and waivers of subrogation.

*(Paragraph deleted)*

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

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

## **§ 6.2 Mutual Responsibility**

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

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

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a Separate Contractors or to other Contractors, because of the Contractor's delays, improperly timed activities or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction, or to property of the Owner, Separate Contractors, or other Contractors as provided in Section 10.2.5. In the event of such damages, the Contractor shall promptly attempt to resolve any dispute with the damaged party. If such a damaged party makes any claim or commences a legal proceeding against the Owner, Construction Manager, or Architect, the Contractor shall defend, indemnify, and hold them harmless against and from such claim or proceeding at the Contractor's sole expense.

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

## **§ 6.3 Owner's Right to Clean Up**

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

## **ARTICLE 7 CHANGES IN THE WORK**

### **§ 7.1 General**

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

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

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

## **§ 7.2 Change Orders**

**§ 7.2.1** A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect, and Contractor, 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.

**§ 7.2.2** Agreement on any Change Order constitutes a final settlement of all matters related to the change in Work that is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time. In the event a Change Order increases the Contract Sum, the Contractor shall include the Work covered by such Change Orders in Applications for Payments as if such Work were originally part of the Contract Documents.

## **§ 7.3 Construction Change Directives**

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

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order. Pending agreement on a Change Order, the Contractor shall provide the Construction Manager such information and documentation as the Construction Manager requires to substantiate adjustment to the Contract Sum in accordance with Section 7.3.3. The Contractors' proposal for such adjustment must be accompanied by a complete itemization of anticipated costs, including labor, materials, and subcontracts.

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

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

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

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Construction Manager and Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;



- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.
- .6 Costs of Bonds shall be limited to 1% of the total additional cost. A 1% Bond credit shall be applied to all credit proposals. Bond premiums and/or credits shall be invoiced per Change Order. Lump sum bond premium requests will not be considered at the end of the project.

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

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

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

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect., without applying any percentage for overhead or profit. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

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

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

§ 7.3.11 The allowance for combined overhead and profit includes supervision, taxes, insurance, field office and all other general expenses and shall be included in the total cost to the Owner based on the following schedule:

- .1 For the Contractor, for Work performed by the Contractor's own forces, fifteen percent (15%) of the cost.
- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, a combined maximum of fifteen percent (15%) of the amount due between Prime Contractor and Subcontractor.
- .3 In order to facilitate checking of quotations for extras and credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, material, and subcontracts. Labor and material shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.
- .4 Costs of Bonds shall be limited to one percent (1%) of the total additional cost. A one percent (1%) Bond credit shall be applied to all credit proposals. Bond premiums and/or credits shall be invoiced per Change Order. Lump sum bond premium requests will not be considered at the end of the project.
- .5 Overhead and profit shall include, but not limited to, the following:
  - .1 home office expenses;
  - .2 field office expense;
  - .3 supervision;
  - .4 project management & estimation;
  - .5 small tools & equipment;

- .6 research & layout;
- .7 inspections & permits
- .8 material handling;
- .9 record drawings; and
- .10 safety and cleanup

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

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

### **ARTICLE 8 TIME**

#### **§ 8.1 Definitions**

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

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

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

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

#### **§ 8.2 Progress and Completion**

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

**§ 8.2.2** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner. The date of commencement of the Work will not be changed by the effective date of insurance required of the Contractor. In the event the effective date of insurance required of the Owner is later than the latest effective date of insurance required of the Contractor, the date of commencement will be adjusted accordingly. The work can not start until required insurance and bonds are provided and the contract has been executed.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. The Contractor agrees that the Work will be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will ensure full completion within the time specified. It is expressly agreed by the Contractor that the time for completion of the Work is a reasonable time for its completion, taking into consideration the average climatic range and usual weather conditions prevailing in the Project's locality.

**§ 8.2.4** In no case may the Contractor delay the progress of the Work, in whole or part, on account of changes in the work or disputes caused by proposed or ordered changes in the work, or any disputes or disagreements as to the equitable value of changes.

**§ 8.2.5** If the Contractor does not achieve Substantial Completion within the Contract Time established in the Agreement, the Contractor shall reimburse the Owner for payments made to the Architect and Construction Manager for additional services rendered by either of them from the end of the Contract Time until Substantial Completion is achieved. The Owner will pay the Architect and the Construction Manager in accordance with its agreements with each of them, and the Owner will back charge the Contractor through an appropriate Modification.

#### **§ 8.3 Delays and Extensions of Time**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner, Architect, Construction Manager, or an employee of any of them, or of the Owner's own forces,

Separate Contractors, or other Contractors; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts and the Architect, based on the recommendation of the Construction Manager, determines justify delay, then the Contract Time shall be extended by Change Order to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time, provided that the performance of the Work is not, was not, or would not have been delayed by any other cause for which the Contractor is not entitled to an extension of the Contract Time under the Contract Documents. The Contractor further acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay (1) is not caused or could not have been anticipated by the Contractor, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay or reasonable likelihood that delay will occur, and (3) is of a duration of more than one (1) day. Nothing contained in this Section 8.3.1 entitles the Contractor to compensation for damages due to hindrance or delay from any cause in the progress of the Work, unless and limited to the extent such delay is caused by the active interference of the Owner, Architect, or Construction Manager, and no claim for compensation may be made by the Contractor or paid by the Owner except to the extent caused by such active interference, and in that event further only to the extent such causation continues after the Contractor furnishes the Architect and Construction Manager with written notice of such causation. The Owner's exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering changes in the Work, or direction suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of the Owner's exercise of such rights or remedies, will not be construed as active interference with the Contractor's performance of the Work. The extension of time provided under this Section 8.3.1 is the Contractor's exclusive remedy, except as otherwise provided and limited in the is Section 8.3.1.

§ 8.3.1.1 Extension of time, if requested in writing by the Contractor, will only be considered after the Contractor has made reasonable effort to recover the lost time.

§ 8.3.1.2 The Contractor is not entitled to receive a separate extension of time for each one of several causes of delay operating concurrently.

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

§ 8.3.3 Notwithstanding anything to the contrary in the Contract Documents, an extension of the Contract Time, to the extent permitted under Paragraph 8.3.1 shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity; or (4) any delay-related claim (collectively referred in this subparagraph 8.3.3 as "Delay") whether or not such Delay is foreseeable. In no event shall the Contractor be entitled to any compensation or recovery of any damages, in connection with any Delay, including, without limitation, consequential damages, lost opportunity cost, impact damaged, labor inefficiency damages, or overhead costs.

§ 8.3.4 When the Contract Time has been extended, as provided under this Section 8.3, such extension of time shall not be considered as justifying extra compensation to the Contractor for administrative costs or other similar reason.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 Contract Sum**

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

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

### **§ 9.2 Schedule of Values**

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Construction Manager, but not later than thirty (30) days after receiving a Notice of Award following bidding, before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Construction Manager and the Architect. This schedule, unless objected to by the

Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. The Construction Manager shall forward to the Architect the Contractor's schedule of values. Any changes to the schedule of values shall be submitted to the Construction Manager and supported by such data to substantiate its accuracy as the Construction Manager and the Architect may require, and unless objected to by the Construction Manager or the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment. Each Schedule of Values forwarded to the Owner by the Construction Manager, or the Architect shall be subject to audit and approval by the Owner in accordance with the Owner's normal audit procedures.

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

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

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

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

**§ 9.3.1.3** Until Substantial Completion, The Owner shall pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments, less an amount necessary to satisfy any claims, liens or judgements against the entire amount retained from previous progress payments less two (2) times the amount required to complete items identified in a list prepared in accordance with Paragraph 9.8.2 and the amount required to satisfy any outstanding claims, liens or judgements against the Contractor.

**§ 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 only if such storage is for other than the convenience of the Contractor and not necessary to maintain the contractor's schedule and shall not increase the Contract Sum.

**§ 9.3.2.1** When payment for materials and equipment stored off site is requested by the Contractor, copies of Bills of Lading and vendor invoices shall accompany Contractor's request for payment. Procedures required by Owner shall include, but are not necessarily limited to, submission by the Contractor to the Architect or Construction Manager of bills of sale and bills of lading for such materials and equipment, provision of opportunity for Architect's or Construction Manager's visual verification and photos that such materials and equipment are in fact in storage, and, if stored off-site, submission by the Contractor of verification that such materials and equipment are stored in a bonded warehouse.

**§ 9.3.2.2** All such materials and equipment, including materials and equipment stored on-site but not yet incorporated into the Work, upon which partial payments have been made shall remain the responsibility of the Contractor until incorporation into the work, including, without limitation, maintaining insurance coverage on replacement cost basis without voluntary deductible.

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

**§ 9.3.2.3** All Contractors are required to submit certified payroll information to the Owner in accordance with New York State Law.

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

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

**§ 9.4.1** Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Certificate for Payment, in the full amount of the Application for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

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

**§ 9.4.2.1** Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

**§ 9.4.3** The Construction Manager's certification of an Application for Payment or, in the case of more than one Contractor, a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

**§ 9.4.4** The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of

the Construction Manager, and data in the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

**§ 9.4.5** The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Construction Manager or Architect.

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

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

**§ 9.5.1** The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.3 and 9.4.4 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers 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 or other 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.
- .8 failure to comply with applicable federal, state, or local statutes, laws, rules, regulations, codes, ordinances, or other governmental requirements, including, without limitation, laws regarding provision of certified payrolls.

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

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

**§ 9.5.4** If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager, and both will reflect such payment on the next Certificate for Payment.

**§ 9.5.5** Notwithstanding anything above to the contrary, the Owner has the right to withhold payment to protect itself against damages incurred or which may be incurred as a result of the Contractor's breach or negligence, including, but not limited to, the items set forth in Article 9.5.1. With respect to any Liens, claims, or other circumstances for which the Owner is entitled to withhold a sum equal to twice the stated amounts of such Liens or claims, or, where there is not stated amount, twice the amount determined by the Architect to be necessary to protect the interests of the Owner. The Owner will release payments withheld due to Liens provided that the Contractor obtains a discharge of record of such lien, by bonding or otherwise. By posting a lien discharge bond, however, the Contractor shall not be relieved of any responsibilities or obligations under the Agreement, including, without limitation, the duty to defend, indemnify, and hold harmless the Indemnitees. The cost of any premiums or other expenses incurred in connection with such bonds or other means of discharge of record shall be the sole responsibility of the Contractor and shall not be part of, or cause any adjustment to, the Contract Sum.

#### **§ 9.6 Progress Payments**

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

**§ 9.6.2** Payments received by the Contractor for Work properly performed by Subcontractors and suppliers will be held in trust by the Contractor for those Subcontractors or suppliers who provided labor, furnished materials, or both, under contracts with the Contractor for which payment was made by the Owner. The Contractor shall strictly comply with any common law, statutory, or decisional law trust fund requirements in the State of New York (including without limitation the requirements of New York Lien Law Article 3-A) and agrees that the Owner has the same rights as any beneficiary of such trusts to examine the books and records of the Contractor to determine such compliance, from time to time and at the Owner's sole discretion. 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. 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.

**§ 9.6.2.1** Payments by the Contractor to its Subcontractors and suppliers is governed by New York State General Municipal Law Section 106-b (2). To the extent there is any conflict between that statutory section, as now in effect or as subsequently amended, and the provisions of this section 9.6.2.1, the provisions of the statute will prevail. Within seven (7) days of receipt of a payment from the Owner, the Contractor shall pay each of his Subcontractors and suppliers for work performed and/or materials furnished by them as reflected in the payment from the Owner, less an amount necessary to satisfy any outstanding claims, liens, or judgements and less a retained amount of not more than 5%, except that the Contractor may retain not more than 10% provided that prior to entering into a subcontract agreement with the Contractor, the Subcontractor is unable or unwilling to provide a performance bond and labor and material bond both in the full amount of the Subcontractor at the request of the Contractor. The Contractor shall not retain portions of the proceeds owed any Subcontractor or supplier from the Owner's payment to the Contractor for the balance of the Contract Sum. Similar provisions apply to the Subcontractors and suppliers paying each of their Sub-subcontractors and materialmen. Nothing in this section creates in the Owner any obligation to pay, or to ensure that the Contractor pays, any Subcontractor or supplier, or any relationship in contract or otherwise, express or implied, between any Subcontractor or supplier and the Owner (except in the event the Owner accepts an assignment under Section 5.4). The Owner agrees that it shall comply with the payment requirements of Section 106-b (2) of the New York General Municipal Law, as amended, and that to the extent there is any conflict between that statutory section and the provisions of this Section 9.6.2.1 the provisions of the statute shall prevail.

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

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

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

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

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

**§ 9.6.8** Not used.

## **§ 9.7 Failure of Payment**

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

**§ 9.7.1** If the Owner is entitled to reimbursement of payment from the Contractor under or pursuant to the Contract Documents, such payment shall be made promptly upon demand by the Owner. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Owner, or the Owner incurs any costs or expenses to cure any default of the Contractor or to correct defective work, the Owner shall have the absolute right to offset such amount against the Contract Sum and may, in the Owner's sole discretion, elect either to (1) deduct an amount equal to that which the Owner is entitled from any payment then or thereafter due the Contractor from the Owner, or (2) issue a written notice to the Contractor reducing the Contract Sum by an amount equal to that which the Owner is entitled.

## **§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. Substantial Completion shall not be deemed to have been reached any earlier than the date the Owner receives a Certificate of Occupancy for the Project. Substantial Completion will not be certified unless the Work remaining to be completed can ordinarily be completed within thirty (30) day period. Warranties called for by the Agreement or by the Drawings and Specifications shall commence on the date of Substantial Completion of the Project or designated portion thereof. This date shall be established by a Certificate of Substantial Completion issued by the Architect, signed by the Owner and Contractor, which shall state their respective responsibilities for security, maintenance, heat, utilities, and damage to the Work, and insurance. This certificate may also include a list of items to be completed or corrected within thirty (30) days together with a price for each item and a time for their completion and correction. The form of the certificate will be AIA Document G734-2019, "Certificate of Substantial Completion, CMA Edition."



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

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

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

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

**§ 9.8.5.1** In conformance with New York General Municipal Law 106-b (1)(a), upon proper execution of Certificate of Substantial Completion of Work, Contractor shall submit a requisition for payment of the remaining amount of the Contract Sum. Upon certification of payment by Architect, Owner will approve and promptly pay the remaining amount of the Contract Sum less two times value of any remaining items to be completed and/or corrected and less an amount necessary to satisfy any claims, liens or judgements against Contractor which have not been suitably discharged. Such payment shall be made under terms and conditions governing final payment except that the Owner's making of such payment shall not constitute the Owner's waiver of any objection to all or any portion of the Work performed by the Contractor or any claims the Owner may then have against the Contractor.

**§ 9.8.5.2** Neither the requisition for payment stipulated nor any portion of retained percentage shall become due until the Contractor submits to the Architect:

1. an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work for which Owner or Owner's property might in any way be responsible, have been paid or otherwise satisfied, the form of which will be AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims";
2. consent of all sureties, if any, to such payment, the form of which will be AIA Document G707A-1994 "Consent of Surety to Reduction in or Partial Release of Retainage," but which will not be required if the amount withheld exceeds the amount of retainage; and
3. if required by Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases, and waivers of liens arising out of contract to such extent and in such form as may be designated by Owner.
4. If any Subcontractor, material supplier, or other party refuses to furnish a release or waiver required by the Owner, the Owner may demand that the Contractor furnish a bond satisfactory to the Owner to indemnify the Owner against a lien or claim by such Subcontractor, material supplier, or other party. The Contractor must obtain such bond within seven (7) days of such demand. If such lien or claim remains unsatisfied after payments are made, the Contractor shall reimburse the Owner for all costs the Owner may incur in discharging or satisfying such lien or claim, including attorneys' fees.

### **§ 9.9 Partial Occupancy or Use**

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

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Construction Manager, 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 completion of the Work, the Contractor shall forward to the Construction Manager a notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, to the Architect, who will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. In the event the Architect determines the Work subject to final inspection is not complete or acceptable, any additional costs the Owner incurs for subsequent inspections by Architect will be deducted from the final payment to the Contractor. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. If the Architect is required to perform additional final inspections because the Work fails to comply with the certifications of the Contractor, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

**§ 9.10.1.1** In addition to any other conditions or requirements contained in the Contract Documents, the Contractor is not entitled to final payment and Final Completion is not deemed to occur until all of the following occur:

1. Substantial completion as described in Section 9.8;
2. the Contractor provides to the Owner three (3) compilations of operating instructions, equipment manuals, guarantees, and warranties bound in a loose-leaf binder;
3. the Contractor provides to the Owner as-built drawings verified by the Architect to reflect the final as-built conditions;
4. the Contractor removes from the Project site any temporary facilities and equipment, including but not limited to temporary utility lines, tools and equipment;
5. the Contractor removes from the Project site materials not used, debris, and rubbish;
6. the Contractor performs all clean-up and site restoration obligations on the Project site; and
7. all other requirements contained in the Contract Documents are completed by the Contractor except for those obligations that expressly survive final payment.

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and

other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

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

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

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

**§ 9.10.5** Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Owner has the right to demand such waiver in writing from contractor as a condition precedent to making final payment.

**§ 9.10.6** The Contractor shall achieve Final Completion not later than thirty (30) days following the date of Substantial Completion. In the event the Contractor fails to achieve Final Completion with that time, the Contractor and the Contractor's surety, if any, are liable for and shall reimburse the Owner for any and all fees paid to the Architect and Construction Manager and any costs of labor or materials, and other expenses made necessary by the Contractor's failure. Additional fees and expenses will be charged by the Owner against any Final Payment due, or which becomes due to the Contractor, and the Contractor shall promptly pay or refund the Owner the excess, if any, upon the Owner's written request.

**§ 9.10.7** At any time a lien is filed against the Project funds by a Subcontractor, Sub-subcontractor, supplier, lessor, or other vendor providing labor, materials, or services to the Contractor for the Project, the Owner may demand that the Contractor discharge said lien of record, through bonding or otherwise, and the Contractor must obtain the discharge of such lien within seven (7) days of such demand.

**§ 9.10.8** The Contractor's warranty and correction obligations under Section 3.5 and 12.2, respectively, as well as any other warranty or correction obligations in the Contract Documents, do not deprive the Owner of any cause of action, right, or remedy otherwise available for breach of any of the provisions of the Contract Documents. No time periods as to any such obligations are limitations on the time within which the Owner may pursue any such cause of action, right, or remedy.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, implementing, directing, controlling, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work for or on behalf of the Contractor or Subcontractor, even if not directly employed by either.

### § 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 ; it;
- .2 the Work and materials and equipment to be incorporated t into the Work, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;
- .3 other property at the site or adjacent to the project site, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction; and
- .4 construction or operations by the Owner, Separate Contractors, or other Contractors.
- .5 the existing buildings and premises in the vicinity of or affected by the Contractor's operations.

§ 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.

§ 10.2.2.1 The Contractor acknowledges that the Labor Law of the State of New York, and rules and regulations promulgated under the Labor Law, place upon both the Owner and the Contractor certain duties that liability for failure to perform those duties is imposed on both the Owner and the Contractor regardless of their respective fault. The contractor agrees that, as between the Owner and Contractor, the Contractor is solely responsible for the compliance with all such laws, rules, and regulations imposed for the protection of persons performing the Contract. The Contractor, subject to any applicable limitations in Section 3.18, shall defend, indemnify, and hold harmless the Owner and Construction Manager of and from any and all liability of violation of such laws, rules and regulations, and shall defend any claims or actions that may be brought against the Owner and the Construction Manager as a result of such violations. In the event the Contractor fails or refuses to defend any such action, the Contractor is liable to the Owner and the Construction Manager for all costs of the Owner arising from such action, including the costs of defending against such action, including without limitation, attorneys' fees incurred in recovering such defense costs from the Contractor.

§ 10.2.2.2 All laborers, workers, and mechanics employed in the performance of the Work of this Project shall be certified as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least 10 hours in duration. The Contractor and its Subcontractors shall conduct their operation in accordance with the Safety Guides for Construction, and the Contractor's safety program.

§ 10.2.2.3 All safety equipment including hard hats and weather protective gear required for the Contractor to perform its Work are to be supplied by the Contractor and/or its Subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its Subcontractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/or essential safety equipment. Each person seen without a hard hat, or otherwise failing to comply with this requirement, will be ordered to leave the Project. No prior warnings will be given by the Owner, Construction Manager or Architect. The Contractor and its Subcontractors shall be solely responsible for making up and paying for any loss of production or required progress resulting from the removal of personnel from the Project as set forth herein including any costs incurred by the Owner in connection with the work of other contractors.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and the Contract Documents reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards. The Contractor is also responsible for all measures necessary to protect any property adjacent to the Project and improvements upon such property. The cost of such measures does not serve as a basis for any increase in the Contract Sum. Any damage to adjacent property or improvements will be promptly repaired by the Contractor at its own expense.

§ 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 under Article 11) to property referred to in Sections 10.2.1.2, 10.2.1.3, 10.2.1.4, and 10.2.1.5 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3, 10.2.1.4, and 10.2.1.5. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.1.8 and shall not be limited by such damage or loss being insured under property insurance required by the Contract Documents.

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

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

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

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, must be given to the other party within a reasonable time, but in any event not exceeding 21 days after discovery. The notice must provide sufficient detail to enable the other party to investigate the matter and must be provided to the Architect and Construction Manager at the same time as provided to the other party.

If during the construction, public or private property is damaged or destroyed as a consequence of its Work, the Contractor responsible shall, at its own expense, restore such property to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or replacing it, or otherwise making good such damage or destruction in an acceptable manner.

#### § 10.3 Hazardous Materials

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the

persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately, and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up, except to the extent any delay or additional costs result from the acts or omissions of the Contractor, its Subcontractors or of anyone else for whose acts or omissions any of them may be liable.

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

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for injury or damages arising from the Contractors' handling, storage, use, removal and disposal of hazardous materials or substances the Contractor brings to the site, whether required by the Contract Documents or otherwise. The Contractor must notify the Owner, Architect, and Construction Manager in writing of any hazardous materials it intends to bring to the Project site not required by the Contract Documents, including written advice as to the intended handling, storage, use, removal, and disposal of such materials, and demonstrate that its liability insurance provides coverage for any injury or damages resulting from such materials.

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

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

**§ 10.3.7** The Contractor covenants that material furnished contain no asbestos.

**§ 10.3.8** The Contractor shall notify the Owner of any storage, use, or discovery of hazardous material on the Project site which the Contractor knows or reasonably should know could cause bodily injury or death and of any injury or death attributable to any such hazardous material.

**§ 10.3.9** The Contractor shall take all reasonable precautions and measures to prevent any contamination by or spread or disturbance of hazardous or potentially hazardous substances or materials stored, used, or discovered on the Project site.

## **§ 10.4 Emergencies**

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

## **ARTICLE 11 INSURANCE AND BONDS**

### **§ 11.1 Contractor's Insurance and Bonds**

**§ 11.1.1** The Contractor shall purchase and maintain insurance of the types and minimum limits of liability and coverage, containing the endorsements, and subject to the terms and conditions, described in Exhibit A to the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the

jurisdiction where the Project is located. Requirements for naming Additional Insureds on specific Contractor insurance policies are included in AIA Document A132-2019 Exhibit A – Insurance and Bonds.

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

**§ 11.1.3** Upon the request to the Contractor 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 copies of the bonds. In the event such request is made to the Owner, the Owner may, at its option, provide copies to the person or entity making the request, or direct the Contractor to do so.

**§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice directly to the Owner, and separately to the Construction Manager, of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

**§ 11.2 Owner's Insurance.** The Owner shall purchase and maintain the Owner's usual liability insurance. The Owner may also, at its sole option, purchase and maintain other insurance for protection against claims that may arise from operations under the Contract Documents. The Contractor is not responsible for purchasing and maintaining such optional Owner's liability insurance unless specifically required in the Contract Documents. Neither the Owner's usual liability insurance nor any other insurance obtained by the Owner reduces or otherwise affects the Contractor's insurance requirements under Section 11.1

*(Paragraphs deleted)*

**§ 11.3 Waivers of Subrogation.**

**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their respective subcontractors, sub-subcontractors, agents, and employees; (2) the Construction Manager and Construction Manager's consultants; (3) the Architect and Architect's consultants; (4) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (5) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by the builder's risk insurance required under Exhibit A-Insurance and Bonds of A132™-2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities enumerated in this Section from the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, other Contractors, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 must not prohibit this waiver of subrogation. This waiver of subrogation will be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

*(Paragraph deleted)*

**§ 11.4**

*(Paragraphs deleted)*

**Adjustment and Settlement of Insured Loss.**

*(Paragraphs deleted)*

**§ 11.4.1** A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to

requirements of any applicable mortgage clause and of Section 11.4.2. The Owner shall pay the Construction Manager, Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Construction Manager, Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

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

## **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

### **§ 12.1 Uncovering of Work**

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

**§ 12.1.2** If a portion of the Work is covered that the Construction Manager or Architect did not specifically request to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it will be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement will, 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 will be at the Contractor's expense unless the condition was caused by the Owner or one of the other contractors, in which event the Owner is responsible for payment of such costs.

### **§ 12.2 Correction of Work**

#### **§ 12.2.1 Before Substantial Completion**

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary by the rejection, will 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 (1) year after the date of Substantial Completion of the Work or a designated portion of the Work, or the date of acceptance of a portion of the Work that is subject to correction or completion after the date of Substantial Completion of the Work, whichever is later, 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 previously gave the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one (1) 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 right to require correction by the Contractor and to make a claim for breach of this Section 12.2.2. 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 (1) year period will be extended with respect to portions of the 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 (1) 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 bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner, separate contractors, or other Multiple Prime Contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents, or in consequence of work performed in fulfilling warranties or guarantees.

§ 12.2.4 Not used.

§ 12.2.5 Nothing contained in this Section 12.2.2 establishes a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one (1) 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.

§ 12.2.6 If the Contractor fails to correct nonconforming Work within a reasonable time, not to exceed fifteen (15) days from the date the Contractor received written notice from the Owner per subparagraph 12.2.2, the Owner may correct it in accordance with Section 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect issued through the Construction Manager, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the Owner may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner, and the Owner shall be permitted to instruct the bonding company to reimburse or pay any amount remaining unpaid to the extent the Contractor has not paid the difference to the Owner within the ten-day period described above. The obligations of the Contractor under the terms and provisions of the Contract Documents shall not, however, be limited to the amount of any surety bond provided by the Contractor.

### § 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.

§ 12.3.1. For this Section 12.3 to apply, the Owner must accept non-conforming Work in writing, specifying the non-conforming Work being accepted. Notwithstanding any acceptance of Work by the Owner, not initially deemed non-conforming, if the Owner subsequently discovers that such Work is non-conforming, the Owner, at its sole option, may either expressly accept such Work in writing, or demand that the Contractor correct such Work under Article 12.

§ 12.3.2 If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Architect's recommendation of final payment, also Architects) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Architect as to reasonableness). If any such acceptance occurs prior to Architect's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 Governing Law

The Contract is governed by the laws of the State of New York, excluding principles of conflicts of law.

### § 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, acknowledgments, representations, and all other obligations contained in the Contract Documents. Except as provided in Article 13, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

*(Paragraph deleted)*

### § 13.3 Rights and Remedies

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

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

§ 13.3.3 Written notice is deemed 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 is 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 Tests and Inspections

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

§ 13.4.2 If the Construction Manager, Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Costs of such additional testing, inspection, or approval, except as provided in Section 13.6, will be at the Owner's expense.

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

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

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

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

§ 13.4.7 Any materials to be furnished shall be subject to inspections and tests in the shop and field by the Architect. Shop inspection shall not relieve the Contractor of the responsibility to furnish satisfactory materials, and the right is reserved to reject any material at any time before final acceptance of the Work, when in the opinion of the Architect the materials and workmanship do not conform to the Specification requirements.

§ 13.4.8 Test specimens will be submitted to an independent laboratory designated by the Architect. Test data will be furnished to the Contractor by the Architect.

### § 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the New York Statutory Rate applicable to the obligations of School Districts.

### § 13.6 Time Limits on Claims

§ 13.6.1 As between the Owner and Contractor:

1. **Before Substantial Completion.** As to acts or failures to act occurring prior to the date of Substantial Completion of all of the Work, any applicable statute of limitations commences to run and any alleged cause of action accrues in any and all events on the date of Substantial Completion;
2. **Between Substantial Completion and the Final Certificate for Payment.** As to acts or failures to act occurring subsequent to the date of Substantial Completion of all of the Work and prior to issuance of the final Certificate for Payment, any applicable statute of limitations commences to run and any alleged cause of action accrues in any and all events on the date of issuance of the final Certificate for Payment; and
3. **After the Final Certificate for Payment.** As to acts or failures to act occurring after the date of issuance of the final Certificate for Payment, any applicable statute of limitations commences to run and any alleged cause of action accrues in any and all events on the date of any act or failure to act by the Contractor pursuant to any warranty provided under Section 3.5, or on the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or on the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner.

§ 13.6.2 Nothing contained in Section 13.7 relieves the Contractor from any time limitations or notice requirements set forth in Article 15 or as provided in New York State Education Law Section 3618 as conditions precedent to instituting any proceeding for binding dispute resolution.

§ 13.7 **No Oral Modification or Constructive Changes** The provisions of the Contract Documents may not be changed, amended, waived, or otherwise modified in any respect except by a writing signed by the Owner and Contractor. No person or entity, including the Architect and Construction Manager, is authorized on behalf of the Owner to orally change, amend, waive, or otherwise modify the terms of the Contract Documents or any of the Contractor's duties or obligations under or arising out of the Contract Documents. Any change, waiver, approval, or consent granted to the Contractor is limited to the specific matters stated in the writing signed by the Owner and Contractor and does not relieve the Contractor of any other duties and obligations under the Contract Documents. No "constructive" changes are allowed.

§ 13.9 **Notices Regarding Liens.** The Contractor shall provide to the Owner copies of all notices of any type regarding liens received from Subcontractors, Sub-subcontractors, or suppliers.

§ 13.10 **Storage Facilities.** The Contractor is responsible for providing storage facilities approved by the Owner for materials and equipment for which payment is received by the Contractor from the Owner, and which is stored off or on the Project site and not yet incorporated into the Work. Such material and equipment must be covered by the Contractor's insurance, identified as property of the Owner, and the Owner has the right to periodic inspection. In addition, materials and equipment stored off-site must be secured in locked enclosures within storage facilities separate from non-Project materials and equipment and must remain in storage until ready for use on the Project. Copies of bills of lading and vendor invoices for such materials and equipment must accompany the Contractor's Applications for Payment.

### § 13.11 Equal Opportunity and Anti-Discrimination

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**§ 13.11.1** The Contractor, Subcontractors, and Sub-Subcontractors shall not discriminate against or intimidate any applicant for employment or employee because of age, race, national origin, color, creed, religion, sex, sexual orientation, marital status, non-disqualifying disability, or other legally protected characteristic (collectively "Protected Characteristics"). The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to Protected Characteristics, including actions related to, without limitation, employment, promotion, demotion, transfer; recruitment, recruitment advertising; layoff, termination, rates of pay or other forms of compensation; and selection for training, including apprenticeship.

**§ 13.11.2** The Contractor, Subcontractors, and Sub-subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to Protected Characteristics.

**§ 13.11.3** The Contractor will post and keep posted in conspicuous places, for employees and applicants for employment, notices obtained by the Contractor from the New York State Division of Human Rights as set forth in the General Regulations of that Division at 9 NYCRR 466.1(a), such conspicuous places to be as defined in 9 NYCRR 466.1(b), and such other postings as that Division may require with respect to New York State's laws, codes, rules, and regulations governing discrimination in employment.

**§ 13.11.4** There may be deducted from amounts otherwise payable to the Contractor by the Owner a penalty in the form of a statutory monetary fine for each person for each calendar day during which such person is discriminated against or intimidated in violation of this Section 13.11 and applicable law.

**§ 13.11.5** The Contract may be terminated by the Owner and all monies due or to become due the Contractor may be forfeited for a second or any subsequent violation of the terms or conditions of this Section 13.11.

## **§ 13.12 New York State Labor Law Requirements**

### **§ 13.12.1 General**

The Contractor shall comply with all applicable provisions of the New York Labor Law ("Labor Law"), including, without limitation, the requirements under the specific provisions cited in this Section 13.12.

### **§ 13.12.2 Working Hours**

**§ 13.12.2.1** The Contractor specifically agrees as required by Labor Law Sections 220 and 220-d, as amended, that no laborer, worker, or mechanic in the employ of the Contractor, Subcontractors, Sub-subcontractors, or other persons or entities doing or contracting to do the whole or any part of the Work, will be permitted or required to work more than eight (8) hours in any one calendar day or more than five (5) days in any one week, except to the extent permitted in the case of extraordinary emergencies described in the Labor Law.

### **§ 13.12.3 Wage Rates**

**§ 13.12.3.1** The wages paid to each laborer, worker, or mechanic in the employ of the Contractor, Subcontractors, Sub-subcontractors, or other persons or entities doing or contracting to do all or any part of the Work for a legal day's work will not be less than the prevailing rate of wages as defined by the Labor Law and as issued by the State of New York Department of Labor for the location and duration of the Project. No change in such prevailing rates during the duration of the Project will form the basis for a change in the Contract Sum.

**§ 13.12.3.2** Each laborer, workman, or mechanic employed by the Contractor, Subcontractors, Sub-subcontractors, or other persons or entities doing or contracting to do all or any part of the Work will be provided the supplements required by Article 8 of the Labor Law.

**§ 13.12.3.3** The Contractor, Subcontractors, and Sub-subcontractors shall comply with all requirements of Labor Law Section 220-a, as amended, regarding mandatory submission of certified payroll records, which must be included with each Application for Payment and which are a condition precedent to the to the Owner's payment of any sums due and owing to the Contractor with respect to the Project.

**§ 13.12.3.4** The Contractor specifically agrees, as provided by the Labor Law, that the Contract may be forfeited and no sum paid for any work done under it on a second conviction for willfully paying less than:

- .1 the prevailing wage rates as provided in Labor Law Section 220(3), as amended; or
- .2 the minimum wage rates as provided in Labor Law Section 220-d, as amended.

### **§ 13.13 CONTRACT DEEMED EXECUTORY**

The Contractor agrees that the Contract shall be deemed executory to the extent of the monies available and that no liability shall be incurred by the Owner beyond the monies available therefor.

## **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, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .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; or
- .3 The Construction Manager does not certify an Application for Payment, or the Architect does not issue a Certificate for Payment and does not notify the Contractor of the reason for withholding certification as provided in Sections 9.4 and 9.5, or because the Owner does not make payment on a Certificate for Payment within the time stated in the Contract Documents. However, the Contractor, following the thirty-day stoppage and as a condition precedent to termination under this Section 14.1.1.3, must notify the Owner, Architect, and Construction Manager of occurrence of any of the foregoing events as to certification or payment as a basis for termination, in writing, and its intent to terminate the Contract as a result seven (7) days following receipt of such notice by the Owner if there is no curc of the occurrence within that seven (7) day period.
- .4 Not used.

Notwithstanding the preceding or anything else in the Contract Documents, the Contractor shall not cease or delay the progress of the Work for any reason other than one set forth in Section 9.7.1, it being agreed that monetary damages shall be an adequate remedy for the Contractor for any breach of this Agreement or the Contract Documents by the Owner.

**§ 14.1.2** Subject to Section 14.1.5, The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, the agents or employees of any of them, or any other persons or entities performing portions of the Work under direct or indirect contracts 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** Subject to Section 14.1.5, If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner, Construction Manager, and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit and direct costs incurred by reason of such termination, but Contractor shall make no Claim nor seek to recover overhead lost anticipated profit or damages in contract for Work not performed by Contractor.

**§ 14.1.4** Subject to Section 14.1.5, If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, the agents or employees of any of them, or any other persons performing portions of the Work under contracts with the Contractor because the Owner repeatedly fails to fulfill the Owner's obligations under the Contract Documents with respect to material matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager, and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

**§ 14.1.5** Any delay, suspension, or interruption under Sections 14.1.1 through 14.1.4 hereof shall not constitute grounds for the Contractor's termination of this Agreement or for additional compensation or payments so long as delay, interruption, or suspension of the Project is caused by or arises out of acts of God, weather, earth movement, lockout or labor trouble, unforeseen restrictive governmental laws, regulations, recommendations, acts or omissions, executive orders, acts or directives of public officials or authorities, public declarations of emergency, epidemics, or acts of war or terrorism which directly or indirectly affect the Project and/or the facilities and services of the Owner, without fault and beyond the reasonable control of the Owner (each, a "Force Majeure Event").

## **§ 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.
- .5 is substantially behind schedule as determined by the Architect, Construction Manager and Owner;
- .6 breaches any warranty made by the Contractor under or pursuant to the Contract Documents; or
- .7 fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the work in compliance with all the requirements of the Contract Documents; or
- .8 repeatedly disregards applicable present and future federal, state, and local government orders, Executive Orders, statutes, ordinances, codes, regulations, recommendations, and guidance relating to safety and health.

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

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

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

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary by the Owner's termination of the Contract, and other damages incurred by the Owner and not expressly waived, such excess will 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, will, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment will survive termination of the Contract.

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

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

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

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

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

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

**§ 14.4.2** Upon receipt of 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.
- .4 complete performance of the Work required under portions of the Contract not terminated, if any.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor is entitled to receive payment for Work executed, for direct costs incurred by reason of such termination and for proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages on the Work performed to the date of termination; but Contractor shall make no Claim nor seek to recover overhead, lost anticipated profit or damages in contract for Work not performed by Contractor. The Contractor waives all other claims for payment and damages, including, without limitation, claims for consequential damages, including lost profits, arising from termination for the Owner's convenience.

## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 Claims

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

### § 15.1.2 Time Limits on Claims

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

### § 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect if the 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.

§ 15.1.3.2 All written claims for damages or extra work shall include time of occurrence, location and other identifying factors and shall be supported if so required by Architect, by letters, journals, or diaries, instructions, vouchers, or other pertinent or applicable records

§ 15.1.3.3 Owner shall not be liable to any Contractor or Subcontractor for damages caused by any breach of Contract, delay in performance or other act of neglect by other Contractors or Subcontractors having Contracts for performance of any portion of work.

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

### § 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 **Claims for Additional Cost.** If the Contractor intends to make a Claim for an increase in the Contract Sum, written notice must be given before proceeding to execute any work that may be the basis for the Claim. However, such work must proceed following the Contractor giving that notice. The basis for a Claim for additional cost may include, but is not limited to, (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, or (6) a Construction Change Directive not executed by the Contractor. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. Each written Claim for Additional Cost must include specific information setting forth the circumstances giving rise to the Claim, and must be supported, if so required by the Architect, by letters, journals, diaries, instructions, vouchers, or other pertinent or applicable records. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3.

§ 15.1.6 **Claims for Additional Time**

§ 15.1.6.1 If the Contractor intends to make a Claim for an increase in the Contract Time, written notice must be given specifying the additional time needed, and the reasons why needed. The Contractor's Claim must include an estimate of cost and of probable effect of delay on progress of the Work. Each written claim for Additional Time must be supported, if so required by the Architect, by letters, journals, diaries, instructions, vouchers, or other pertinent or applicable records. To the extent the Contractor seeks an increase in the Contract Sum in connection with a Claim for an increase in the Contract Time, the Contractor must also comply with the provisions of Section 15.1.4. A new Claim for an increase in the Contract Time is necessary in the event of a continuing delay beyond the additional time previously claimed as needed.

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

§ 15.1.7 **Waiver of Claims for Consequential Damages.** The Contractor waives Claims against the Owner for consequential damages arising out of or relating to

*(Paragraphs deleted)*

the Contract. This waiver includes 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. This waiver is applicable, without limitation, to all consequential damages due to termination of the Contractor in accordance with Article 14.

§ 15.2 **Initial Decision**

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, must be referred to the Initial Decision Maker for an 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, a written claim made in accordance with this Article and an initial decision are required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days pass after the Claim is referred to the Initial Decision Maker with no decision being rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision



Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

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

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

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

**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days of receipt thereof, 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**

The parties hereto at the time any claim or dispute arises between them may, in their sole personal discretion, agree to submit the same to non-bonding mediation upon such terms and conditions as may be agreed at the time; but the decision to do so must be unanimous between them and must be in writing in advance thereof. The request for mediation is not deemed a condition precedent to any other right or remedy of the aggrieved party, all of which rights and remedies are expressly reserved by the parties.

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

**§ 15.3.2** Mediation will be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation must 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 will proceed in advance of binding dispute resolution proceedings, which will be stayed pending completion of mediation. 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 will be held in the place where the Project is located. Agreements reached in mediation are enforceable as settlement agreements in any court with proper jurisdiction.

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

## **§ 15.4 Arbitration**

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

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

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

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

## **§ 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 demand joinder of 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, and who are under contract with that party with respect to the Project under agreements containing arbitration provisions that do not prohibit such joinder. Any other 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 may be joined by their consent in writing to such joinder. Consent to arbitration involving an additional person or entity does not constitute consent by that additional person or entity to arbitration of any claim, dispute or other matter in question not described in the written consent.

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

## **ARTICLE 16 CONFORMANCE TO THE LAWS OF THE STATE OF NEW YORK**

**§ 16.1** The parties agree that each is bound to the provisions of the laws of the State of New York governing bidding and contracting for public improvement projects, including but not limited to applicable provisions of the General Obligations Law, Labor Law, Education Law, State Finance Law, and General Municipal Law. To the extent any provisions in the Contract Documents conflict with any provisions of New York Law, the statutory provisions prevail and the conflicting provisions in the Contract Documents are deemed to conform to the statutory provisions.

**§ 16.2** To the extent the laws of the State of New York governing bidding and contracting for public improvement projects mandate inclusion of specific terms in contracts for such improvements, but which are not already included in these General Conditions or elsewhere in the Contract Documents, such terms are deemed incorporated into these General Conditions.

## SECTION 01 1000 – MULTIPLE CONTRACT SUMMARY

### **PART 1 GENERAL**

#### *1.1     RELATED DOCUMENTS*

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

#### *1.2     SUMMARY*

- 1. This section includes:
  - 1. Design/Management Identification.
  - 2. Work covered by Contract Documents.
  - 3. Coordination.
  - 4. Work Sequence.
  - 5. Prime Contractors Use of Premises
  - 6. Occupancy Requirements
  - 7. Prime Contractors Scope of Work.
- 2. Related Sections:
  - 1. All Division 1 Specification Sections

#### *1.3     DESIGN / MANAGEMENT IDENTIFICATION*

OWNER:           Lake Shore Central School District  
                      959 Beach Road  
                      Angola, NY 14006-9702

ARCHITECT/ENGINEER:  
                      Young + Wright Architectural  
                      50 Elk Street, Suite 200  
                      Buffalo, New York 14210  
                      Phone: (716) 842-1800  
                      Contact: Erin Brand, Project Coordinator  
                      E-mail: [ebrand@youngandwright.com](mailto:ebrand@youngandwright.com)

CONSTRUCTION MANAGER:  
                      Campus Construction Management Group, Inc.  
                      6225 Sheridan Drive  
                      Suite 100  
                      Williamsville, NY 14221  
                      Contact: Sarah Wilder, Project Manager  
                      E-mail: [swilder@campuscmg.com](mailto:swilder@campuscmg.com)  
                      Cell: (585) 474-3373

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Description
1. The project consists of renovation of existing buildings and sites at the following locations:
    - High School
    - Middle School
- B. Contract Documents, dated September 3, 2026, were prepared for the Project by Young + Wright Architectural, Buffalo, New York 14210.
- C. The Work will be constructed under multiple Prime Contractor Agreements. One set of contract documents are issued covering the multiple Prime Contracts. Prime Contracts are separate contracts between the Owner and independent Contractors representing significant construction activities. Each Prime Contract is performed concurrently and closely coordinated with construction activities performed on the Project under other Prime contracts.
- D. **Prime Contracts for this project consist of:**
- CONTRACT 301: SITEWORK  
CONTRACT 302: GENERAL TRADES  
CONTRACT 303: PLUMBING  
CONTRACT 304: MECHANICAL  
CONTRACT 305: ELECTRICAL
- E. The following Contract Document Specification sections are specifically included and defined as integral to the scope of work for each Prime Contract:

#### **DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS**

000101 – PROJECT TITLE PAGE  
000110 – TABLE OF CONTENTS  
001116 – INVITATION TO BID  
002113 – INSTRUCTIONS TO BIDDERS  
002113.1 – INSTRUCTIONS TO BIDDERS\_ AIA DOCUMENT A701-2018  
002113.2 – INSTRUCTIONS TO BIDDERS\_ BIDDER QUESTION FORM  
003100 – AVAILABLE PROJECT INFORMATION  
003100.2 – AVAILABLE PROJECT INFORMATION\_ PREVAILING WAGE RATES  
003100.3 – AVAILABLE PROJECT INFORMATION\_ AIA DOCUMENT A132-2019  
003100.4 – AVAILABLE PROJECT INFORMATION\_ AIA DOCUMENT A132-2019 –  
EXHIBIT A  
003100.5 – AVAILABLE PROJECT INFORMATION\_ HAZ MAT REPORT  
004113.1 – BID FORM – GENERAL TRADES  
004113.2 – BID FORM - SITE  
004113.3 – BID FORM – ELECTRICAL  
004113.4 – BID FORM – MECHANICAL  
004113.5 – BID FORM – PLUMBING  
007200 – GENERAL CONDITIONS  
007200.1 – GENERAL CONDITIONS\_ AIA DOCUMENT A232-2019

## DIVISION 1 – GENERAL REQUIREMENTS

- 01 1000 – MULTIPLE CONTRACT SUMMARY
- 01 2100 – ALLOWANCES
- 01 2200 – UNIT PRICES
- 01 2600 – CONTRACT MODIFICATION PROCEDURES
- 01 2900 – PAYMENT PROCEDURES
- 01 3100 – PROJECT MANAGEMENT AND COORDINATION
- 01 3200 – CONSTRUCTION PROJECT DOCUMENTATION
- 01 3233 – PHOTOGRAPHIC DOCUMENTATION
- 01 3300 – SUBMITTAL PROCEDURES
- 01 4000 – QUALITY REQUIREMENTS
- 01 4100 – SPECIAL INSPECTIONS
- 01 4200 – REFERENCES
- 01 4500 – SAFETY STANDARDS FOR SCHOOL CONSTRUCTION AND  
MAINTENANCE PROJECTS
- 01 5000 – TEMPORARY FACILITIES AND CONTROLS
- 01 6000 – PRODUCT REQUIREMENTS AND SUBSTITUTIONS
- 01 7300 – EXECUTION
- 01 7419 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
- 01 7700 – CLOSEOUT PROCEDURES
- 01 7823 – OPERATION AND MAINTENANCE DATA
- 01 7839 – PROJECT RECORD DOCUMENTS
- 01 7900 – DEMONSTRATION AND TRAINING
- 01 9113 – COMMISSIONING REQUIREMENTS

- F. Drawing Index: Each Prime Contractor is responsible for information provided in the contract documents, which includes both the drawings and specifications. Information may be located on multiple drawings or specifications. **Consequently, every Prime Contractor is responsible for information on every drawing so listed in the enumeration of drawings.**
- G. Definition of Extent of Prime Contract Work: The Specification Sections are assigned by contract. Where multiple contractors are each assigned the same specification section, further clarification is provided for what each contractor owns for the work of their contract.
- H. All Federal, New York State, Town/Village or local government or School District laws, code, standards, rules and regulations including, but not limited to, Zoning, planning, fire, health, tax, insurance, safety, OSHA, criminal, building code, plumbing code, HVAC code, utility company, traffic, labor, transportation, environmental, and education.
- I. **The following notes are integral to all Prime Contracts:**
  - 1. ***Immediately upon award of contracts by the District; all Prime Contractors are required to implement and maintain a site-specific Project Safety Program. Each Contractor shall submit their Safety Program to the Construction Manager for review and approval, PRIOR to the start of any work on site. The Safety Program shall include company safety philosophy, history, action plan, manuals, hazardous communications sheets, OSHA filings and reporting systems for any accidents or injuries.***

2. All Bidders are forewarned to review **all** information in the Contract Documents.
3. All Bidders are strongly recommended to visit the site to verify and review existing conditions before estimating the cost of the project to ensure their bid to the Owner takes into account site constraints as well as access constraints to the site in a rural environment.
4. Review Section 01 3200.1 for Project Schedule.
5. Review Section 01 2300 for Alternates assigned to each prime contract.
6. All submittals are to be submitted in accordance with the timeframes established in the submittal schedule in Section 01 3300 or as modified by the Contractor in writing to the Construction Manager to improve the Contractor's project delivery.
7. Review Section 01 5000 for work requirements of temporary construction activities in each Prime Contractor's Scope of Work.
8. All Contractors are responsible for the layout and survey of their own work, unless otherwise noted elsewhere in the Contract Documents.
9. All Contractors are required to construct the project per the Project Phasing and Plans. Contractors must complete specific area of the site and building for use by the District on or before the dates listed in Section 01 3200.1. All Contractors shall cooperate fully with the intentions of the plan. All Prime Contractors are specifically forewarned that any delays caused directly or indirectly by their acts, omissions, and/or failure to perform will result in the District, or its agents, completing the Prime Contractor's Work by whatever means are needed to complete the Work. The Prime Contractor causing the delay will be responsible for any and all costs associated with such issues including, but not limited to, District, Architectural, Construction Management, Legal, and Inspections costs, plus costs submitted by Contractors hired to complete the Prime Contractor's Work-in specific areas.
10. All Contractors shall provide any and all temporary shoring, bracing, support, or protection systems necessary to expedite their Work requirements, including the maintenance of workers safety and compliance with OSHA safety regulations.
11. All Contractors are responsible, individually and collectively, for maintaining safe-working conditions at all times. Shoring plans must be submitted to the Construction Manager prior to work.
12. All Contractors are responsible for the safety of their own Workers, Sub-Contractors, and other personnel on site. Each and every Contractor is responsible for maintaining a safe work site, and for maintaining safe work procedures. Protect all District facilities, personnel, students, and activity areas.
13. Dewatering is the responsibility of each Prime Contract.
14. Each Prime Contractor is responsible for providing adequate manpower as needed throughout the course of the project to maintain the overall schedule and milestone dates.
15. For identification and security purposes, workers are required to wear photo-identification badges at all times while working at District occupied sites. Each

Contractor is responsible for control, maintenance and updating of the badges worn by their personnel. The Construction Manager will provide the equipment and process for creating photo-identification badges. Badges can be obtained at the Campus Construction Management Group field office.

16. All Prime Contractors are required to clean their own work area at the end of each workday. All Prime Contractors shall provide daily debris removal. Failure to comply with cleaning requirements will activate Owner remedies.
17. All Prime Contractors performing sub grade work shall request public utility underground location stakeout immediately upon award of contract. A private Underground Utility Locating Contractor shall be hired by the Prime Contractor performing sub grade work to locate the District's private underground utilities within the work area. Contractors shall be responsible for maintaining these stakeout location marks throughout construction and submitting an as-built drawing showing location of all located underground utilities, whether public or private, at the end of construction. Backfilling and compaction of excavations required to perform sub grade work shall be the responsibility of the Contractor requiring the excavation. Coordinate backfilling and compaction with the Construction Manager to assure proper scheduling of required testing.
18. Cutting, removal and patching of concrete slabs is the responsibility of the Contractor requiring the slab removals, unless otherwise noted on the Contract Documents. This includes both partial and/or total slab removals that are required for the work of the Contract.
19. The District has the right of first refusal for any equipment and/or materials being removed or disposed. The Contractor will move at their own expense, any equipment and/or materials requested by the District to a designated location.
20. The Prime Contractors are responsible for coordination of their work and their subcontractors work.
21. Each Prime Contractor shall procure services of a qualified contractor to provide all necessary ramps and leveling of crane locations wherever and whenever needed for access of crane throughout the worksite as required for the Work of their Contract.
- 22. Each Prime Contractor shall provide a competent field superintendent/foreman at ALL TIMES/SHIFTS during self-performed work and during work of their subcontractors. Changes in field superintendent/foreman shall be approved by Construction Manager 7 days prior to change. Prime Contractors may be subject to a deduct change order to their contract if field superintendent/foreman are not present while work is being completed under the scope of work of their contract.**
23. Each Prime Contractor must have a decision-making representative present at each weekly Progress Meeting and Field Managers Meeting. Other periodic meetings may also be scheduled, which will be attended by the contractor's onsite supervisor.
24. During the active school year, material deliveries into the work areas that are surrounded by student occupied spaces are to occur prior to 8:00 am and after 3:25 pm.

25. Walls shall be restored to a smooth uniform surface condition after selective demolition of items such as, but not limited to, signs, tack strips, clocks, light fixtures, etc.
26. All Contractors are required to follow the EPA's Renovation, Repair and Painting Final Rule (40 CFR 745).
27. Each Contractor is required to provide cutting and patching operations to complete the work of their contract.
- 28. Lockdown/Lockout and Fire Alarm drills by the District must be followed by all Contractors.**
29. Each Contract is responsible to remove and replace/patch existing ceilings to facilitate their work, unless ceilings are shown to be demolished and/or replaced per the Contract Drawings.
30. All Prime Contractors shall maintain within their field office, as well as each gang box at each school; a current and complete set of Contract Documents (including any Addenda, Change Orders or Modifications thereto), approved shop drawings, samples, color schedules and other data pertinent to the Project.
31. Each Prime Contractor is to survey existing work and conditions and submit to the Construction Manager a written list of damaged areas (e.g.: ceiling tiles) prior to commencing work. Any damaged areas not identified prior to start of work shall be the responsibility of the Contractor/Contractors working in that area. Each Prime Contractor shall return areas disturbed by their work activities to the condition prior to start of Work.
32. There will be NO contact between the Contractor or their personnel and any of the school's students or staff. The Contractors are not to take direction from anyone but the Construction Manager, Architect or Engineer.
33. Contractors are **prohibited** from using District toilet room facilities and/or teacher lounges/break areas.
34. Dust Control for Site Work Contract (Contract #301) must always be maintained. The Site Work Contractor shall supply and utilize water for dust control for their scope of work.
35. The Construction Manager will receive copies of all Prime Contractors daily reports by 10:00 AM, listing daily activities and manpower by trade and title.
36. Hard hats are required for identification purposes and safety.
- 37. Alcohol, drugs, tobacco products, electronic cigarettes, firearms, pornography, profanities, are strictly forbidden from the project.** There is a zero tolerance for the use of any such products. Possession or use of such will result in an immediate termination and permanent discharge from the project.
38. Each Prime Contractor's Contract is active and will remain so, until the Architect authorizes a signed Substantial Completion Certificate.



39. Contractors are required to turn in Operations and Maintenance Manuals, Warranties, Guarantees, As-Built Drawings, training sign in sheets (as per contract) and test reports (as per contract) within 15 working days of Substantial Completion.
40. Any original Deficiency List or Punchlist distributed by the Construction Manager or the Architect must be returned showing completion of each item within 15 working days of receipt of such list.
41. All Contractors are required to wash their vehicles that will track mud onto the public roadways each time leaving the site.
42. All Contractors are responsible to replace ceilings and ceiling tiles they damage. The Construction Manager will be final arbitrator of the extent to which each contractor shall be responsible for replacement of ceiling tiles damaged. All ceilings and ceiling tiles will be replaced to match original.
43. A project specific SDS file shall be maintained on-site at the Construction Manager's office. The contractor must submit a copy of the SDS's for those compounds to be used on-site with each product submittal. All SDS sheets shall be on file prior to those compounds being allowed on-site.
44. Due to the small amount of work, Each contractor shall provide Dumpster service for the work of their contract. Coordinate with the Construction Manager for dumpster locations. Dumpsters to be dumped and cleaned on a regular basis to prevent overflow.
45. All Contractors are notified that the use of gasoline or diesel-powered engines is prohibited within the existing building.
46. All Contractors are notified that the dry-cutting of masonry or gypsum-based products with rotary cutting equipment is prohibited on the project site.
47. All workers must meet the requirements of Labor Law 220-h to perform work on the project site. OSHA 10 cards must be provided by the respective employee at issuance of project identification badge.
48. All Contractors are notified that the project site has hazardous materials present containing asbestos, PCB's, and lead. Contractors are strongly encouraged to review such information prior to bidding and / or commencing work on the project.
49. All Contractors are specifically notified that the scope of their contract may be conducted in multiple locations of the project at the same time and they shall review the Project Phasing Plans and ensure their company is properly staffed and that the quantity of equipment is on hand to address this multiple location project. The Owner will not accept the contractor not having sufficient manpower and equipment to complete this project and will move swiftly to rectify a situation where the contractor is not able to complete the scheduled work.
50. The State Education Department has established a rule that noise levels due to construction activity cannot exceed 60dba, when measured with type 2 sound level meter, in areas occupied by school students or the school's staff. All Prime Contractors need to anticipate construction activities that will produce noise levels above 60dba and schedule this Work accordingly when students and staff are not present. Any construction noise that exceeds 60dba, in school occupied areas, will be shut down by the Construction

Manager and the responsible Prime Contractor will be asked to perform the operation when the area is not occupied by the school. No additional compensation will be allowed for compliance with this regulation.

#### *1.5 COORDINATION*

- A. The Construction Manager will manage the coordination of the work of all Prime Contracts. All prime Contractors shall cooperate with each other and coordinate work with other Contractors and Suppliers, who will, under separate Contract with the District, provide certain labor, equipment, and materials for the project. All Contractors will ensure materials are on site and ready for installation in accordance with the construction schedule to not delay other Contractors' work.
- B. The Contractor shall provide forty-eight (48) hours' notice to the Special Inspections Testing Agency for any special inspection testing required to allow for scheduling with the Testing Agency. Work performed without 48-hour notice to Special Inspections Testing Agency will be at the Contractor's expense to perform special inspection with either nondestructive or destructive testing procedures.

#### *1.6 WORK SEQUENCE*

- A. All Work will be conducted in a number of continuous phases (refer to Project Phasing Plan and Project Schedule) structured to minimize interference with the activities of the District's personnel and structured to permit the facilities to be occupied during construction and renovations at the existing school buildings. Work that has been phased for times other than the summer recess must be performed in a manner that minimizes interference with normal school operations in a manner that complies with the requirements of NYSED 155.5 "Unified Safety Standards for School Construction and Maintenance Projects".
  - 1. Each Prime Contractor is responsible for providing adequate manpower as needed throughout the course of the Project to maintain the overall construction schedule and milestone dates.
  - 2. See Specification Section 01 3200.1 for specific requirements.
- B. **During Winter Break (12/24/2026-1/1/2027), February Break (2/15/2027-2/19/2027), Spring Break (3/29/2027-4/2/2027) & Summer Recess (6/28/2027-8/27/2027), Winter Break (12/20/2027-12/31/2027), February Break (2/21/2028-2/25/2028)\*, Spring Break (4/17/2028-4/21/2028)\* and Summer Recess (6/26/2028-9/1/2028) all work shall be performed 1st shift and 2<sup>nd</sup> shift from between the hours of 6:00 AM and 6:00 PM, Monday through Friday, unless otherwise authorized by the District and its agents in advance. All other work activities during the Academic School year shall be performed on 2<sup>nd</sup> shift. All contractors should plan that 50% of work will be required to be completed on 2<sup>nd</sup> shift or weekends at no additional cost to the District. All noisy work shall occur prior to student arrival at 7:30 AM or after student departure at 3:00 PM, 2<sup>nd</sup> Shift or weekends at no additional cost to the District. All work shall be done first shift unless authorized by the district and its agents in advance. (No work shall be performed in occupied areas of the existing building unless the work area is isolated from the occupied area in accordance with NYSED 155.5 Unified Safety Standards for School Construction and Maintenance Projects.) Unoccupied areas of existing buildings during school holidays and breaks shall generally be available for construction 24 hours daily, with 48 hours advance notice by Contractor requiring access. All work to be coordinated with and approved by the District through the Construction Manager. Activity**

and access shall be confined to the designated staging and construction areas. All exits and escape windows shall always be maintained. Activity in the staging area shall be conducted in a manner that causes minimal disruption to District operations. Any Work that requires disruption to existing building occupants, entries, exits, utilities, etc. shall be coordinated with and approved by the District through the Construction Manager. Start of workday where noise is generated and disruptive to adjoining neighborhoods start time will be subject to local noise ordinances at no costs for compliance shall be passed onto the district. Contractors are subject to start and finish times of equipment in accordance with local noise ordinances and Contractors are responsible for associated costs and maintain the schedule.

- C. All additional costs for overtime or second or third shift work required by any Contractor to ensure work completion in accordance with the project completion dates in the Project Schedule and Project Phasing Plan will be the responsibility of the Contractor. Service shutdowns, utility transfers, work in occupied spaces when necessary are to be completed nights, weekends, holidays etc... and all costs shall be borne by the Contractor.
- D. Each Bidder shall plan labor, materials (including long lead items), equipment and subcontractors as needed to complete Work in accordance with the project completion schedule, including punch list completion. See the Project Schedule and Project Phasing Plan in Section 01 3200.1 for area specific completion requirements at each building site. Each Contractor shall provide sufficient manpower, including extended hours, premium/multiple shifts hours, weekend and holiday hours to assure that the work of their Contract is substantially complete and ready for the Owner's beneficial occupancy.
- E. During the Academic School year while school is in session, removal and haul out of Demolition material and Asbestos Containing Debris from interior rooms that do not have an exterior exit point, can only occur on 2<sup>nd</sup> shift through the building. Coordinate with the Construction Manager and Lake Shore CSD for route of removal through the building.
- F. During the Academic School year while school is in session, delivery of material to interior rooms that do not have an exterior exit point can only occur on 2<sup>nd</sup> shift through the building. Coordinate with the Construction Manager and Lake Shore CSD for route of material delivery through the building.

#### *1.7 PRIME CONTRACTOR USE OF PREMISES*

- a. General: The Contractors shall limit their use of the premises to the Work areas indicated in the Contract documents.
- b. Use of the Site: Limit use of the premises to Work areas indicated in the Contract documents. Confine operations to areas within Contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
  - 1. District Occupancy: Allow for District occupancy and use of the existing building and by the public during construction. The District will occupy the site and existing buildings throughout the duration of the project. The District will continue to occupy portions of the building throughout holiday, conference days, workshop days, community activities and summer breaks throughout the duration of the construction project. Contractor work will be coordinated with the District through the Construction Manager to facilitate Contractor access to occupied areas of existing buildings during these summertime periods.

2. Driveways and Entrances: At all times, driveways and entrances serving the premises shall be kept clear and available to the District, the District's employees and emergency vehicles. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  3. All Contractors must not have deliveries or influence of any kind to the Bus schedule at any of the buildings. Specific schedules will be provided at a later date.
- c. Use of Existing Buildings: Maintain the existing buildings in a serviceable and weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

#### *1.8 OCCUPANCY REQUIREMENTS*

- A. District Occupancy: See 1.7.B.
- B. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work. Cooperate fully with the District or his representative during construction operations to minimize conflicts and to facilitate Owner usage. Perform the work so as not to interfere with the District's operation.
1. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will operate and maintain mechanical and electrical systems serving occupied portions of the building.
  2. Upon occupancy, the Owner will assume responsibility for maintenance and custodial service for occupied portions of the building. However, the District will not clean up behind Contractors; responsibility for any debris caused by Contractor operations remains with the Prime Contractor.

1.9 **PRIME CONTRACTORS SCOPE OF WORK**

The following summarizes the Scope of Work for the Prime Contracts for this project:

**A.) CONTRACT 301: SITEWORK**

Provide all material, labor, equipment, supervision, management, and administration required for the total performance of the Work of this Contract including:

**1. Work of the following Divisions and Specification Sections:**

**DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS**

**DIVISION 01 – GENERAL REQUIREMENTS**

**DIVISION 02 – EXISTING CONDITIONS (For the work of this contract)**

02 4119 SELECTIVE DEMOLITION

**DIVISION 31 – EARTHWORK (For the work of this contract)**

31 1201 SITE PREPARATION

31 2100 EARTH MOVING WITHIN BUILDING

31 2201 SITE EARTHWORK

31 2501 EROSION, SEDIMENT, AND POLLUTION CONTROL

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

32 1201 ASPHALT PAVING

32 1301 SITE CONCRETE WORK

32 3001 TRAFFIC SIGNS

32 9201 SODDED LAWNS

**DIVISION 33 – STORM DRAINAGE**

32 4001 STORM DRAINAGE

**Notes to Site Work Contractor (Contract #301)**

**The Site Work Contractor (Contract #301) is responsible for all material, labor, equipment, supervision, management, and administration required for the total performance of the work of this contract including:**

- a. Site Work Contract (Contract #301) includes all site demolition such as utilities, paving, fencing, trees, shrubs, landscaping, etc., and offsite legal disposal of same and the protection and maintenance of all existing utilities throughout construction, including those to be relocated or replaced as scoped in item a above.
- b. Site utilities are the responsibility of the Site Work Contractor (Contract #301). The Site Work Contractor (Contract # 301) shall pay all costs and fees associated with the utilities installation, as scoped in item a above.
- c. The Site Work Contractor (Contract #301) is responsible for offsite disposal of unsuitable spoil resulting from the excavation work of their contract.

- d. All sidewalks including tactile warning surfaces, curbing, exterior ramps, exterior stairs, exterior seating, fences, railings, gates, retaining walls, etc. are the responsibility of the Site Work Contractor (Contract #301) as scoped in item a above.
- e. Roads need to be cleaned and maintained on a continuous basis. Keep roads clean of mud and debris for work of this contract. This includes but is not limited to scraping, sweeping, and washing. No materials to be tracked off site. If materials are tracked off site, it shall be cleaned up immediately.
- f. Wherever construction activities take place that are the responsibility of this prime contract, the Site Work Contractor (Contract #301) is to provide construction safety fencing for the duration of the entire project, separating the construction site from all other areas of activity (i.e. residential neighborhood, existing sidewalks, roadways, buildings, etc.) Reference the Site Safety and Logistics Plans for each building site for temporary safety fencing layout as scoped in item a above.
- g. All Prime Contractors are required to clean their own work area at the end of each workday.
- h. All Traffic Control Devices are the responsibility of the Site Work Contractor (Contract #301) for the work of their contract.
- i. All yard hydrants and connection of are the responsibility of the Site Work Contractor (Contract #301) for the work of their contract.
- j. At all fencing located in pavement and concrete, the contractor shall install fence posts and foundations prior to installation of the top course of paving.
- k. The Site Work Contractor (Contract #301) is required to engage a land surveyor registered in the state of New York to establish and maintain sufficient property and easement line locations as well as locations, elevations and grades for construction of all site work components required on this project for the work of their contract. All Information is to be clearly marked for identification by other trades.
- l. All permitting required for curb cuts on public streets or rights of way is the responsibility of the Site Work Contractor (Contract #301) including any fees or additional bonding required by the permit agency for the work of their contract.
- m. The Site Contractor (Contract #301) shall be responsible for maintaining adequate access for the Phase 2 Site Contractor working on the multipurpose fields.

## **B.) CONTRACT 302: GENERAL TRADES**

Provide all material, labor, equipment, supervision, management, and administration required for the total performance of the Work of this Contract including:

### **1. Work of the following Divisions and Specification Sections:**

#### **DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS**

#### **DIVISION 01 – GENERAL REQUIREMENTS**

#### **DIVISION 02 – EXISTING CONDITIONS**

|         |                                                      |
|---------|------------------------------------------------------|
| 02 4119 | SELECTIVE DEMOLITION (For the Work of this Contract) |
| 02 8213 | ASBESTOS ABATEMENT                                   |
| 02 8333 | REMOVAL OF MATERIALS CONTAINING LEAD                 |

#### **DIVISION 03 – CONCRETE**

|         |                                  |
|---------|----------------------------------|
| 03 1000 | CONCRETE FORMING AND ACCESSORIES |
| 03 2000 | CONCRETE REINFORCING             |
| 03 3000 | CAST-IN-PLACE CONCRETE           |

#### **DIVISION 04 – MASONRY**

|            |                          |
|------------|--------------------------|
| 04 0120.63 | BRICK MASONRY REPAIR     |
| 04 0120.64 | BRICK MASONRY REPOINTING |

#### **DIVISION 05 – METALS**

|         |                          |
|---------|--------------------------|
| 05 1200 | STRUCTURAL STEEL FRAMING |
| 05 5213 | PIPE AND TUBE RAILINGS   |

#### **DIVISION 06 – WOOD, PLASTICS AND COMPOSITES**

|         |                                                  |
|---------|--------------------------------------------------|
| 06 1000 | ROUGH CARPENTRY                                  |
| 06 4116 | PLASTIC-LAMINATE-FACED<br>ARCHITECTURAL CABINETS |

#### **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

|         |                |
|---------|----------------|
| 07 9200 | JOINT SEALANTS |
|---------|----------------|

#### **DIVISION 08 – OPENINGS**

|         |                                              |
|---------|----------------------------------------------|
| 08 1113 | HOLLOW METAL DOORS AND FRAMES                |
| 08 1416 | FLUSH WOOD DOORS                             |
| 08 4113 | ALUMINUM-FRAMED ENTRANCES AND<br>STOREFRONTS |
| 08 4413 | GLAZED ALUMINUM CURTAIN WALLS                |
| 08 7100 | DOOR HARDWARE                                |
| 08 8000 | GLAZING                                      |
| 08 8300 | MIRRORS                                      |
| 08 8700 | WINDOW SECURITY GLAZING FILMS                |
| 08 8813 | FIRE-RATED GLAZING                           |

#### **DIVISION 09 – FINISHES**

|         |                              |
|---------|------------------------------|
| 09 2216 | NON-STRUCTURAL METAL FRAMING |
| 09 2900 | GYPSUM BOARD                 |
| 09 3013 | CERAMIC TILING               |
| 09 5113 | ACOUSTICAL PANEL CEILINGS    |

|         |                                         |
|---------|-----------------------------------------|
| 09 5400 | EXTRUDED ALUMINUM SPECIALTY<br>CEILINGS |
| 09 6513 | RESILIENT BASE AND ACCESSORIES          |
| 09 6519 | RESILIENT TILE FLOORING                 |
| 09 6723 | RESINOUS FLOORING                       |
| 09 6814 | TEXTILE COMPOSITE FLOORING              |
| 09 7200 | DIGITAL WALL COVERINGS                  |
| 09 8433 | SOUND ABSORBING WALL UNITS              |
| 09 9123 | INTERIOR PAINTING                       |

#### **DIVISION 10 - SPECIALTIES**

|            |                                       |
|------------|---------------------------------------|
| 10 1100    | VISUAL DISPLAY UNITS                  |
| 10 2113.19 | PLASTIC TOILET COMPARTMENTS           |
| 10 2600    | WALL AND DOOR PROTECTION              |
| 10 2800    | TOILET, BATH, AND LAUNDRY ACCESSORIES |
| 10 5100    | SOLID PLASTIC LOCKER BENCHES          |

#### **DIVISION 11 – EQUIPMENT**

|         |                      |
|---------|----------------------|
| 115123  | LIBRARY SYSTEMS      |
| 11 6623 | NATATORIUM EQUIPMENT |

#### **DIVISION 12 - FURNISHINGS**

|           |                                |
|-----------|--------------------------------|
| 122413    | ROLLER WINDOW SHADES           |
| 123661.16 | SOLID SURFACING COUNTERTOPS    |
| 124813    | ENTRANCE FLOOR MATS AND FRAMES |

#### **Notes to the General Trades Contract (Contract #302)**

**The General Trades Contractor (Contract #302) is responsible for all material, labor, equipment, supervision, management, and administration required for the total performance of the work of this contract including:**

- a. General Trades Contractor (Contract #302) specific selective demolition:
  1. All interior and exterior building demolition complete, including but not limited to concrete, masonry, structural and miscellaneous steel, decking, doors and frames, windows, specialties, equipment, furnishings, casework, partitions, floors, flooring, ceilings, etc.
  2. All patching to match finishes of surfaces affected by the demolition work of this Contract. Surfaces scheduled to receive new finishes per the room finish schedule are to be patched ready to receive the new finishes.
  3. Cutting, shoring, and removal of structural members.
  4. Cutting of openings in partitions for new doors including patching to match of floor, wall and ceiling finishes.
- b. Review Section 01 5000 for work requirements of temporary construction activities in the Prime Contractors scope of work.
- c. Roads need to be cleaned and maintained on a continuous basis. Keep roads clean of mud and debris for work of this contract. This includes but is not limited to scraping, sweeping, and washing. No materials to be tracked off site. If materials are tracked off site, it shall be cleaned up immediately.



- d. The General Trades Contractor (Contract #302) shall be responsible for quality assurance of selective demolition performed under The General Trades Contractor (Contract #302) and will be responsible for damage to the Owner's property or the work of others.
- e. The General Trades Contractor (Contract #302) shall provide all patching and scraping necessary to prepare existing walls for new finishes. Preparation shall include scraping of existing paint and wallpaper where deemed necessary to receive new finish scheduled.
- f. The General Trades Contractor (Contract #302) shall provide all rough carpentry blocking required for the work of their contract.
- g. The General Trades Contractor (Contract #302) shall provide temporary enclosure of all new and existing unit ventilators louver openings with plywood and 2"x4" framing until the permanent louvers are installed.
- h. The Mechanical Contractor (Contract #302) shall procure the louvers for the unit ventilator openings and turn over the General Trades Contractor (Contract #202) for installation.
- i. The General Trades Contractor (Contract #302) shall be responsible for caulking around all new louvers.
- j. The General Trades Contractor (Contract #302) is responsible for checking, securing and locking all windows, doors, gates, and temporary entrances for security purposes for all shifts.
- k. The General Trades Contractor (Contract #302) shall perform the final cleaning of the project before the facilities are turned over to the District for their use. At that time, the General Trades Contractor (Contract #302) will contract a professional cleaning service to perform the final cleaning service for the work of their contract.
- l. The General Trades Contractor (Contract #302) is responsible for interior caulking of all windows, sills to adjacent surfaces and shall caulk all joints where concrete, masonry and gypsum adjoin.
- m. The General Trades Contractor (Contract #302) is required to patch existing surfaces to match existing where new openings in walls have been created.
- n. The General Trades Contractor (Contract #302) is responsible to patch all wall surface defects prior to painting any walls indicated to receive new paint finish on the Contract Documents. This is to include minor dings, scratches, plaster cracks etc. to ensure all walls are free of defects when turned over to the Owner.
- o. The General Trades Contractor (Contract #302) shall provide Asbestos Abatement work per the contract documents.

- p. The General Trades Contractor (Contract #302) shall provide all structural steel support for mechanical devices as shown on the structural drawings. The General Trades Contractor (Contract #302) shall also provide structural steel support for all miscellaneous mechanical penetrations as detailed on the structural drawings including but not limited to exhaust fan openings, roof drains and duct penetrations. The Mechanical Contractor (Contract #304) shall coordinate layout with the General Trades Contractor (Contract #302).
- q. The Mechanical Contractor (Contract #304) shall supply at all buildings the following:
  - 1. Roof flashing for new equipment for re-flashing for rework of existing equipment for Mechanical, Electrical or Plumbing roof penetrations and or new mechanical unit ductwork and blocking or new mechanical, electrical or plumbing piping through the roof.
  - 2. Install new roof curbs furnished by the Mechanical, Electrical and Plumbing Contractors.
  - 3. Cut all roof openings required by Mechanical, Electrical and Plumbing Contractors.
- r. Where shown on the contract drawings, The Mechanical Contractor (Contract #304) is responsible to install and flash all roof curbs, pipe penetrations, equipment rails, and any other penetrations required for the installation of all Mechanical, Electrical equipment on all buildings. Include all shimming and blocking as required for proper installation. Refer to Contract Drawings for quantities and approximate locations. The General Trades Contractor (Contract #302) shall be responsible for all steel work as shown on the drawings.
- s. The General Trades Contractor (Contract #302) shall paint the exposed ceiling including all exposed conduits, ductwork, piping, etc. except as follows:
  - i. Painting of exposed piping, HVAC ductwork and conduit in Mechanical Rooms, Boiler Rooms and Electrical Rooms shall be by the installing Contractor as noted on the Contract Documents.
- t. The General Trades Contractor (Contract #302) shall be responsible for coordinating with the Mechanical Contractor (Contract #304) on the installation of the snowmelt system at the Main Entry stairs and ramps.
- u. The General Trades Contractor (Contract #302) shall be responsible for providing temporary hand rails at the Main Entry stair and ramps if the permanent handrails are not installed in time for the start of the 2027 school year.

### **C.) CONTRACT 303: PLUMBING CONTRACT**

Includes mechanical construction. Provide all material, labor, equipment, supervision, management, and administration required for the total performance of the Work of this Contract for Plumbing Work including:

1. Work of the following Divisions and Specification Sections:

**DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS**

**DIVISION 01 – GENERAL REQUIREMENTS**

**DIVISION 02 – EXISTING CONDITIONS (For the work of this contract)**

02 4119 SELECTIVE DEMOLITION

**DIVISION 03 – CONCRETE (For the work of this Contract)**

03 3200 CONCRETE REINFORCING  
03 3000 CAST-IN-PLACE CONCRETE

**DIVISION 22 – PLUMBING**

22 0511 MECHANICAL, ELECTRICAL, PLUMBING  
COORDINATION  
22 0513 COMMON WORK RESULTS FOR PLUMBING  
22 0517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING  
22 0518 ESCUTCHEONS FOR PLUMBING PIPING  
22 0523 GENERAL-DUTY VALVES FOR PLUMBING PIPING  
22 0529 HANGERS AND SUPPORTS FOR PLUMBING PIPING  
AND EQUIPMENT  
22 0553 IDENTIFICATION FOR PLUMBING PIPING AND  
EQUIPMENT  
22 0719 PLUMBING PIPING INSULATION  
22 1116 DOMESTIC WATER PIPING  
22 1119 DOMESTIC WATER PIPING SPECIALTIES  
22 1316 SANITARY WASTE AND VENT PIPING  
22 1319 SANITARY WASTE PIPING SPECIALTIES  
22 4000 PLUMBING FIXTURES

#### **Notes to Plumbing Contract (Contract #303)**

**The Plumbing Contractor (Contract #303) is responsible for all material, labor, equipment, supervision, management, and administration required for the total performance of the work of this contract including:**

- a. Plumbing bidders shall visit the site to verify and review existing conditions before estimating the cost of the project.
- b. The Plumbing Contractor (Contract #303) is responsible for any permits or fees required by the contract documents for the work of this contract.
- c. Review the Construction Documents for selective demolition requirements in Prime Contractors scope of Work.
- d. The Plumbing Contractor (Contract #303) contract specific selective demolition:

1. All plumbing demolition, including hangars, piping, insulation, fixtures, drains, and accessories to facilitate, the Plumbing Contractor's (Contract #303) Scope of Work, or to meet code requirements.
  2. Surfaces scheduled to receive new finishes per the room finish schedule are to be patched and ready to receive the new finish.
  3. Coordinate cutting of all openings through roof deck with the General Trades Contractor (Contract #303).
  4. Cutting required openings in floors, walls, ceilings to fulfill the Contractors Scope of Work.
- e. The Plumbing Contractor (Contract #303) shall provide the General Trades Contractor (Contract #302) with all auxiliary embedded items that need to be installed including sleeves, etc. Coordinate and furnish the products on a timely basis to avoid any delays in the scheduled completion of each phase.
  - f. The Plumbing Contractor (Contract #303) shall coordinate and install ALL plumbing fittings, faucets and components when furnished by others PLUS any furnished by this contract.
  - g. The Plumbing Contractor (Contract #303) is responsible for ALL final connections to plumbing equipment and mechanical equipment inside the building footprint.
  - h. The Plumbing Contractor (Contract #303) shall note the Plumbing equipment is intended to be provided in accordance with the completion dates indicated on the Phasing Plan and Project Schedule.
  - i. All contractors shall provide any and all temporary shoring, bracing, support or protection system necessary to expedite their Work requirements, including the maintenance if workers' safety and compliance with OSHA safety regulations.
  - j. The Plumbing Contractor (Contract #303) will provide all gas piping (interior and exterior) required of the Contract documents including all fittings, flexible connectors, and final connections to equipment.
  - k. The Plumbing Contractor (Contract #303) shall paint all new interior and exterior Natural Gas Piping as per specifications.
  - l. The General Trades Contractor (Contract #302) shall paint the exposed ceiling including all exposed conduits, ductwork, piping, etc. except as follows:

1. Painting of exposed piping, HVAC ductwork and conduit in Mechanical Rooms, Boiler Rooms and Electrical Rooms shall be by the installing Contractor as noted on the Contract Documents.
- m. The Plumbing Contractor (Contract #303) shall provide concrete work per Section 03 3000 for all concrete work and housekeeping pads pertaining to the Plumbing Contractor (Contract #303) Scope of Work.
- n. The Plumbing Contractor (Contract #303) shall provide all plumbing fixtures and trims as indicated on the Plumbing Fixture Schedule and provide utilities for proper operation.
- o. Plumbing Contractor (Contract #303) will fire caulk, fire safe, etc... as necessary any place its contract penetrates a fire rated system, not limited to hangers, supports, sleeves, pipe, etc.
- p. The Plumbing Contractor (Contract #303) shall provide temporary protection for work of Plumbing Contract until time of final cleaning by The General Trade Contractor (Contract #302).
- q. The Plumbing Contractor (Contract #303) shall furnish all roof curbs required for the work of their contract to the Mechanical Contractor (Contract #304) for installation.
- v. The Mechanical Contractor (Contract #304) shall supply at all buildings the following:
  1. Roof flashing for new equipment for re-flashing for rework of existing equipment for Mechanical, Electrical or Plumbing roof penetrations and or new mechanical unit ductwork and blocking or new mechanical, electrical or plumbing piping through the roof.
  2. Install new roof curbs furnished by the Mechanical, Electrical and Plumbing Contractors.
  3. Cut all roof openings required by Mechanical, Electrical and Plumbing Contractors.
- r. The Plumbing Contractor (Contract #303) is responsible for seismic bracing required to complete their scope of the work as indicated in the Contract Documents.
- s. The General Trades Contractor (Contract #302) shall provide all structural steel support for mechanical, electrical and plumbing devices as shown on the structural drawings. The General Trades Contractor (Contract #302) shall also provide structural steel support for all miscellaneous mechanical, electrical and plumbing penetrations as detailed on the structural drawings including but not limited to exhaust fan openings, roof drains and duct penetrations. The Plumbing Contractor (Contract #303), Mechanical Contractor (Contract #304) and Electrical Contractor (Contract #305) shall coordinate layout with the General Trades Contractor (Contract #302).

- t. The Plumbing Contractor (Contract # 303) furnish access doors for the work of their contract to the General Trades Contractor (Contract #302) for installation into new and existing concrete, masonry or gypsum wall board assemblies.
- u. The Plumbing Contractor (Contract #303) is responsible for all final plumbing connections to all new and existing relocated fixtures and equipment supplied by others including but not limited to casework and fume hoods.
- v. The Plumbing Contractor (Contract #303) is responsible for all final plumbing connections to all new and existing appliances as shown on the documents.
- w. Site Utility installation is the responsibility of the Site Work Contractor (Contract #301) and starts 5' outside of each building. The Site Work Contractor (Contract #301) shall make final connections to storm, sanitary and water. Where utilities run parallel to the building exterior it is the intent that the Site Work Contractor (Contract #301) will take these utilities from the other prime contractors at the point where the utility exits the building and complete installation of the utilities.
- x. The Plumbing Contractor (Contract #303) shall coordinate with the Owners Commissioning Agent on startup procedures as necessary to allow for completion of Commissioning on new plumbing equipment.

#### **D.) CONTRACT 304: MECHANICAL CONTRACT**

Includes mechanical construction. Provide all material, labor, equipment, supervision, management, and administration required for the total performance of the Work of this Contract for Mechanical Work including:

- 1. Work of the following Divisions and Specification Sections:

##### **DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS**

##### **DIVISION 01 – GENERAL REQUIREMENTS**

##### **DIVISION 02 – EXISTING CONDITIONS (For the work of this Contract)**

|         |                      |
|---------|----------------------|
| 02 4119 | SELECTIVE DEMOLITION |
|---------|----------------------|

##### **DIVISION 03 – CONCRETE (For the work of this Contract)**

|         |                        |
|---------|------------------------|
| 03 3200 | CONCRETE REINFORCING   |
| 03 3000 | CAST-IN-PLACE CONCRETE |

##### **DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

|         |                                                  |
|---------|--------------------------------------------------|
| 23 0500 | COMMON WORK RESULTS FOR HVAC                     |
| 23 0510 | BASIC MECHANICAL MATERIALS AND METHODS           |
| 23 0511 | MECHANICAL, ELECTRICAL, PLUMBING<br>COORDINATION |

|         |                                                                  |
|---------|------------------------------------------------------------------|
| 23 0513 | COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT                     |
| 23 0517 | SLEEVES AND SLEEVE SEALS FOR HVAC PIPING                         |
| 23 0518 | ESCUTCHEONS FOR HVAC PIPING                                      |
| 23 0519 | METERS AND GAUGES FOR HVAC PIPING                                |
| 23 0523 | GENERAL-DUTY VALVES FOR HVAC PIPING                              |
| 23 0529 | HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT               |
| 23 0548 | WIND AND OR SEISMIC LOAD RATED ROOF CURBS AND RESTRAINT BRACKETS |
| 23 0553 | IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT                     |
| 23 0593 | TESTING, ADJUSTING, AND BALANCING FOR HVAC                       |
| 23 0713 | DUCT INSULATION                                                  |
| 23 0716 | HVAC EQUIPMENT INSULATION                                        |
| 23 0718 | REFRIGERANT PIPING INSULATION                                    |
| 23 0719 | HVAC PIPING INSULATION                                           |
| 23 0800 | COMMISSIONING OF HVAC                                            |
| 23 0923 | DIRECT DIGITAL CONTROL SYSTEM FOR HVAC                           |
| 23 0993 | SEQUENCE OF OPERATIONS FOR HVAC CONTROLS                         |
| 23 2113 | HYDRONIC PIPING                                                  |
| 23 2213 | STEAM AND CONDENSATE HEATING PIPING                              |
| 23 2216 | STEAM AND CONDENSATE HEATING PIPING SPECIALTIES                  |
| 23 2300 | REFRIGERANT PIPING                                               |
| 23 2500 | HVAC WATER TREATMENT                                             |
| 23 3113 | METAL DUCTS                                                      |
| 23 3300 | AIR DUCT ACCESSORIES                                             |
| 23 3423 | HVAC POWER VENTILATOR                                            |
| 23 3713 | DIFFUSERS, REGISTERS, AND GRILLES                                |
| 23 3723 | HVAC GRAVITY VENTILATORS                                         |
| 23 5700 | HEAT EXCHANGERS FOR HVAC                                         |
| 23 6313 | CONDENSING UNITS                                                 |
| 23 7413 | ROOFTOP AIR CONDITIONING UNITS                                   |
| 23 8126 | SPLIT-SYSTEM AIR-CONDITIONERS                                    |
| 23 8223 | UNIT VENTILATORS                                                 |
| 23 8239 | CABINET UNIT HEATERS                                             |
| 23 8316 | RADIANT HYDRONIC PIPING                                          |
| 23 9119 | FIXED LOUVERS                                                    |

**The Mechanical Contractor (Contract #304) is responsible for all material, labor, equipment, supervision, management, and administration required for the total performance of the work of this contract including:**

- a. The Mechanical Contractor (Contract #304) is responsible for any permits or fees required by the contract documents for the work of this contract.
- b. All mechanical demolition, including equipment, ductwork, hangars, piping, insulation, and housekeeping pads to facilitate, the Mechanical (HVAC) Contractor Scope of Work, or to meet code requirements.
- c. The Mechanical Contractor (Contract #304) Contract specific selective demolition:
  1. All mechanical demolition, including duct, pipe and all associated mechanical equipment to facilitate, the Mechanical Contractor (Contract #304) Scope of Work, or to meet code requirements.

2. Coordinate cutting of all openings through roof deck with the General Trades Contractor (Contract #302).
  3. Patching of all surfaces exposed due to mechanical equipment replacement or piping removal.
  4. Surfaces scheduled to receive new finishes per the room finish schedule are to be patched and ready to receive the new finish. Other areas to be patched and matched to adjacent surfaces.
  5. Cutting of openings required for ductwork in existing partitions and any necessary support of new openings.
- d. The General Trades Contractor (Contract #302) shall receive and install into new concrete and masonry work all auxiliary embedded items furnished by other Contractors, including lintels, sleeves, access doors, grouting of base plates etc., provided the products are delivered on a timely basis. Furnish the products on a timely basis to avoid any delays in the scheduled completion of each area of work.
  - e. The Mechanical Contractor (Contract #304) shall procure the louvers for the unit ventilator openings and turn over the General Trades Contractor (Contract #202) for installation.
  - f. The Mechanical Contractor (Contract #304) shall note that the mechanical equipment is to be provided in accordance with the completion dates indicated on the Phasing Plan and Project Schedule.
  - g. The Mechanical Contractor (Contract #304) is responsible to remove and re-install all mechanical components such as diffusers and grilles where ceilings are scheduled to be removed and replaced.
  - h. The General Trades Contractor (Contract #302) shall provide all structural steel support for mechanical devices as shown on the structural drawings. The General Trades Contractor (Contract #302) shall also provide structural steel support for all miscellaneous mechanical penetrations as detailed on the structural drawings including but not limited to exhaust fan openings, roof drains and duct penetrations. The Mechanical Contractor (Contract #304) shall coordinate layout with the General Trades Contractor (Contract #302).
  - i. The Mechanical Contractor (Contract #304) shall supply at all buildings the following:
    1. Roof flashing for new equipment for re-flashing for rework of existing equipment for Mechanical, Electrical or Plumbing roof penetrations and or new mechanical unit ductwork and blocking or new mechanical, electrical or plumbing piping through the roof.
    2. Install new roof curbs furnished by the Mechanical, Electrical and Plumbing Contractors.
    3. Cut all roof openings required by Mechanical, Electrical and Plumbing Contractors.
  - j. Where shown on the contract drawings, The Mechanical Contractor (Contract #304) is responsible to install and flash all roof curbs, pipe penetrations, equipment rails, and any other penetrations required for the installation of all Mechanical, Electrical equipment on all buildings. Include all shimming and blocking as required for proper installation. Refer to Contract Drawings for quantities and approximate



locations. The General Trades Contractor (Contract #302) shall be responsible for all steel work as shown on the drawings.

- k. The Mechanical Contractor (Contract #304) shall protect all roof openings for new equipment to prevent leaks until permanent equipment is in place. The Mechanical Contractor (Contract #304) will provide patching and flashing after placement of equipment.
- l. The Mechanical Contractor (Contract #304) shall furnish access doors for the work of their contract to The General Trades Contractor (Contract #302) for installation into new and existing concrete, masonry, or gypsum wall board assemblies.
- m. The Mechanical Contractor (Contract #304) shall provide all balancing of existing duct systems as required of the Contract Drawings.
- n. The Mechanical Contractor (Contract #304) shall provide all temperature control work required of the Contract Drawings.
- o. The Mechanical Contractor (Contract #304) shall provide adequate support and protection of the existing Mechanical (HVAC) systems until such time as the new systems are in place and ready for use by the District.
- p. The Mechanical Contractor (Contract #304) shall be responsible for a Pre-Demo TAB report for record.
- q. The Mechanical Contractor (Contract #304) is notified that final balancing of systems and the submission of final balance reports are required to achieve substantial completion. It is of vital importance this work is completed in a timely manner. Contractor shall plan work to ensure balancing and reporting is completed at Substantial Completion.
- r. The Mechanical Contractor (Contract #304) is responsible to relocate and re-balance all existing air devices where indicated in the Contract Documents.
- s. The Mechanical Contractor (Contract #304) shall remove and reinstall louvers to permit equipment installation into the building as required to complete their scope of work.
- t. Mechanical Contractor (Contract #304) shall provide all pumps, expansion tanks, air separators, heat exchangers, valves, strainers, control valves, and chemical feeders.
- u. Prior to installation of any piping or pipe accessories the Mechanical Contractor (Contract #304) shall layout and confirm pipe routing will work successfully to complete the intended scope of work provided in the Contract Documents.
- v. The General Trades Contractor (Contract #302) shall install box-outs, and sleeves where required within new concrete and masonry work for mechanical, electrical, and plumbing items to pass thru. The contractor requiring the box-out or sleeves are responsible to coordinate locations and provide the box-outs and sleeves to the General Trades Contractor (Contract #302).

- w. The Mechanical Contractor (Contract #304) shall provide temporary protection for work of their contract until time of final cleaning by The General Trade Contractor (Contract #202).
- x. The Mechanical Contractor (Contract #304) shall provide mechanical valve dots for new work of their contract on new and existing ACT Grid for identification.
- y. The Mechanical Contractor (Contract #304) shall coordinate with the Owners Commissioning Agent on startup procedures as necessary to allow for completion of Commissioning on new mechanical equipment.
- z. The Mechanical Contractor (Contract #304) shall coordinate the installation of the snowmelt system with the General Trades Contractor (Contract #302). The system shall be operational for the Winter 2027.
- aa. The General Trades Contractor (Contract #302) shall paint the exposed ceiling including all exposed conduits, ductwork, piping, etc. except as follows:
  - 1. Painting of exposed piping, HVAC ductwork and conduit in Mechanical Rooms, Boiler Rooms and Electrical Rooms shall be by the installing Contractor as noted on the Contract Documents.

## **E.) CONTRACT 305: ELECTRICAL**

Provide all material, labor, equipment, supervision, management, and administration required for the total performance of the Work of this Contract including:

- 1. Work of the following Divisions and Specification Sections:

### **DIVISION 00 – BIDDING REQUIREMENTS, CONTRACT FORMS AND CONDITIONS OF THE CONTRACT**

### **DIVISION 01 – GENERAL REQUIREMENTS**

### **DIVISION 02 – EXISTING CONDITIONS (For the work of this contract)**

02 4119 SELECTIVE DEMOLITION

### **DIVISION 26 – ELECTRICAL**

|         |                                         |
|---------|-----------------------------------------|
| 26 0500 | COMMON WORK RESULTS FOR ELECTRICAL      |
| 26 0511 | MECHANICAL, ELECTRICAL, PLUMBING        |
|         | COORDINATION                            |
| 26 0519 | LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS |
|         | AND CABLES                              |
| 26 0526 | GROUNDING AND BONDING                   |
| 26 0529 | HANGERS AND SUPPORTS FOR ELECTRICAL     |
|         | SYSTEMS                                 |
| 26 0533 | RACEWAYS AND BOXES                      |
| 26 0544 | SLEEVES AND SLEEVE SEALS FOR ELECTRICAL |
|         | RACEWAYS AND CABLING                    |
| 26 0553 | IDENTIFICATION FOR ELECTRICAL SYSTEMS   |
| 26 0923 | LIGHTING CONTROL DEVICES                |

|         |                                        |
|---------|----------------------------------------|
| 26 2416 | PANELBOARDS                            |
| 26 2726 | WIRING DEVICES                         |
| 26 2813 | FUSES                                  |
| 26 2816 | ENCLOSED SWITCHES AND CIRCUIT BREAKERS |
| 26 5100 | LIGHTING                               |
| 26 7150 | VOICE AND DATA COMM CABLING            |

**DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

|         |            |
|---------|------------|
| 28 4261 | FIRE ALARM |
|---------|------------|

**Notes to Electrical Contractor (Contract #305)**

**The Electrical Contractor (Contract #305) is responsible for all material, labor, equipment, supervision, management, and administration required for the total performance of the work of this contract including:**

- a. The Electrical Contractor (Contract #305) is responsible for any permits or fees required by the contract documents for the work of this contract.
- b. The Electrical Contractor (Contract #305) shall note that the electrical equipment is to be provided in accordance with the completion dates indicated on the Phasing Plans.
- c. The Electrical Contractor (Contract #305) shall provide adequate support and protection of the existing electrical service, telephone service, security systems and computer networks until such time the new systems are in place and ready for use by the Owner.
- d. Coordinate all electrical work with all contractors and Construction Manager. All electrical work on the drawings is the responsibility of The Electrical Contractor (Contract #305), including all final connections to building services and equipment.
- e. The Electrical Contractor (Contract #305) specific selective demolition:
  1. All electrical demolition, including devices, hangers, piping, wiring, equipment to facilitate the Electrical Contractor (Contract #305) Scope of Work, or to meet code requirements.
- f. The Electrical Contractor (Contract #305) shall provide all pre-cast concrete pad or concrete work per Section 32 1301, for the scope of their work.

- g. The Electrical Contractor (Contract #305) is responsible for ALL electrical hook-ups and final connections needed for all new and relocated existing equipment.
- h. The Electrical Contractor (Contract #305) is responsible for fire caulk, fire safe etc... as necessary any place its contract penetrates a fire rated system, not limited to hangers, supports, duct, pipe etc...
- i. The Electrical Contractor (Contract #305) shall, where removed items create holes, install replacement cover plates that match existing color and finish or remove existing anchors, patch and finish to match.
- j. The Electrical Contractor (Contract #305) shall provide adequate support and protection of the electrical systems until such time as the new systems are in place and ready for use by the District. Maintain all existing systems including District requirements for power, lighting, safety, and communication systems throughout the construction project.
- k. The Electrical Contractor (Contract #305) shall update all panel directories on a weekly basis. The completion of all work, The Electrical Contractor (Contract #305) shall provide all new computer-generated updated panel directories for any panel where work was performed.
- l. The Electrical Contractor (Contract #305) shall receive and install into concrete and masonry work all auxiliary embedded items furnished by other Contractors, including lintels, sleeves, grouting of base plates etc., provided the products are delivered on a timely basis.
- m. The Electrical Contractor (Contract #305) shall install box-outs and sleeves where required within new concrete and masonry work for the scope of their work.
- n. All relocation of existing panels and extensions of or shortening of branch circuits and feeders are the responsibility of the Electrical Contractor (Contract #305).
- o. The Electrical Contractor (Contract #305) shall provide all conduit, wiring and final power and data connections for all sport field equipment provided by others including but not limited to the scoreboards and associated speakers and shot clocks, etc.

**END OF SECTION 01 1000**

## SECTION 012100 - ALLOWANCES

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Contingency allowances.

### 1.2 DEFINITIONS

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

### 1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

### 1.4 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

## 1.6 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs. Overhead and profit are to be included in the contract sum for allowances. Therefore the Contractor is not entitled to overhead and profit on work compensation for under the allowances.
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

## 1.7 PROCEDURE FOR AUTHORIZATION OF ACCESS TO ALLOWANCES

- A. Overhead and profit are to be included in the contract sum for allowances. Therefore the Contractor is not entitled to overhead and profit on work compensation for under the allowances.
- B. Contractor shall submit proposals as outlined in section 012600.
- C. Complete Proposals shall be reviewed by the Architect and the Owner's Representative and forward to the Owner with Recommendations.
- D. If the proposal is accepted by the owner, the Architect will prepare an "Allowance Authorization" form
  - 1. The Architect forwards the authorization to the contractor for signatures.
  - 2. If the Contractor accepts the terms then he signs and returns it to the Owner's Representative.
  - 3. The Owner's Representative signs it and returns all of the copies to the architect.
  - 4. The architect signs and sends one copy to the Contractor and one copy to the Owner's Representative.
  - 5. Once all parties have received a fully executed copy of the Authorization, the contractor may charge the agreed upon amount in the next Application for Payment. Authorizations should be identified separately by number on the payment applications.
- E. The value of the directed work under this allowance will be determined by one or more of the following methods which is to be specified in the written directive.
  - 1. By accepting an amount agreed upon by both parties. Such amount shall be calculated in a manner similar to that described in item (3) below.
  - 2. By applying the applicable price or prices set forth in the Contract Documents or by applying unit prices agreed to by both parties.
  - 3. By estimating the fair and reasonable cost of:
    - a. Labor including all wages, required wage supplements and insurance required by law (workers comp, social security, disability, unemployment, etc.) paid to or on behalf of foreman, workers, and other employees below the rank of Contractors designated representative directly employed at the site.
    - b. Materials

- c. Equipment, excluding hand tools.
  - d. All required bonds and liability and fire insurance premiums whether required by this contract or a subcontract between the contractor and a subcontractor actually performing the extra work.
- 4. By determining the actual cost of the extra work in the same manner as in the foregoing paragraph except that the actual cost of the contractor will be utilized in lieu of estimated costs. The owner reserves the right to utilize this method provided it notifies the contractor of its intent to do so prior to the time that the contractor is properly authorized to commence performance of such work.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. Allowance #1: The Site Contractor shall include in their Base Bid a sum of \$25,000 for site soil/grading changes authorized by the Owner and as directed by the Construction Manager.
- B. Allowance #2: The Site Contractor shall include in their Base Bid a sum of \$10,000 for site drainage maintenance authorized by the Owner and as directed by the Construction Manager.
- C. Allowance #3: The General Trades Contractor shall include in their Base Bid a sum of \$50,000 for vinyl graphic design and installation as described in the drawings. Owner to make final decision on qualified graphic designer and installer
  - 1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.
  - 2. Allowance includes a minimum of (2) design meetings with the Owner to develop and approve vinyl graphic proofs for each location shown in the drawings. Images shown in the drawings are conceptual for reference only.
- D. Allowance #4: The General Trades Contractor shall include in their Base Bid a sum of \$20,000 for elevator maintenance as authorized by the Owner and as directed by the Construction Manager.

- E. Allowance #5: The Mechanical Contractor shall include in their Base Bid a sum of \$250,000 for steam trap replacements as authorized by the Owner and as directed by the Construction Manager.

END OF SECTION 012100



## SECTION 012200 - UNIT PRICES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.

#### 1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as stated in the bid form, a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

#### 1.3 PROCEDURES

- A. Unit prices may be used for changes to the scope of work, and is processed via change order. Unit prices shall include all necessary labor, material, handling, delivery, installation, equipment, tools, fittings, insulation, storage, hoisting, distribution, protection of materials, clean-up, field and office supervision, fringe benefits, and insurance. Overhead and profit are to be excluded. The unit prices apply for the NET change in quantity for each change request issued. If additional bonding costs are required, a net change percentage will be added to the net total cost of the change. A single unit price shall govern for both adds and deducts. Unit prices are firm for the life of the project.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 SCHEDULE OF UNIT PRICES

- A. Schedule of Unit Prices: A schedule of unit prices is listed on the individual bid forms for each contract. Contractors must provide all unit prices with their respective bid submissions. The unit prices will be reviewed by the Construction Manager and Architect prior to awarding the

contract to ensure that the unit prices are fair and reasonable. Final unit prices will be negotiated and approved by the Construction Manager, Architect, and Contractor. The Owner reserves the right to reject any bid whereby all parties cannot come to an agreement. Specification sections and drawings directly referenced or implied in the schedule contain the application, quality, and performance requirements described under each unit price.

END OF SECTION 012200

## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.

#### 1.2 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
  - 2. Include as part of each alternate all overhead, profit and other expenses in connection there with.
- B. Alternate selection will be exercised at the option of the owner as follows:
  - 1. The owner reserves the right to accept or reject alternate bids in any combination, sequence or order.
  - 2. The owner reserves the right to accept alternate bids at any time during the contract period prior to the start of work for the alternate.
- C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- D. Execute accepted alternates under the same conditions as other work of the Contract.
- E. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

**Alternate #1:** All remaining curb replacement:

The Bidder shall state the amount to be **ADDED** to the Base Bid for all site construction work associated with replacing all the remaining concrete curb within the work area, as shown on the site preparation plan with note 10 (alternate). Contractor shall assume approximately 1,070' linear feet of replacement. This shall include, but not limited to, site preparation, drainage work, and lawn restoration as shown on the concrete curb detail. Note: If this alternate is NOT accepted by the Owner, all concrete curb replacement shown on the plans in this area is included in the Base Bid.

END OF SECTION 012300

## SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

#### 1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on through a web based construction management program selected by the Architect.

#### 1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. All proposals shall include detailed material and labor breakdowns.
    - b. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - c. Indicate applicable, delivery charges, equipment rental, and amounts of trade discounts.
    - d. Include costs of labor and supervision directly attributable to the change.
    - e. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
  - 1. All proposals shall include detailed material and labor breakdowns.
  - 2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

3. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
5. Include costs of labor and supervision directly attributable to the change.
6. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
7. Comply with requirements in Section 016000 "Product Requirements and Substitutions" if the proposed change requires substitution of one product or system for product or system specified.
8. Proposal Request Form: The quotation must be submitted on a change proposal form provided by the Architect. Be sure to attach all required back-up information from subcontractors and suppliers to support pricing.

#### 1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor, through a web based construction management program selected by the Architect.
- B. Change orders will be issued for items that are added to the scope of work, not included for payment under the Contingency Allowance.
- C. Complete Proposals shall be reviewed by the Architect and the Owner's Representative and forward to the Owner with recommendations.
- D. If the proposal is accepted by the Owner, the Architect will prepare a Change Order (four copies) using AIA document G701 or G701/CM or a comparable document.
  1. The Architect forwards the Change Order to the Contractor for signature.
  2. If the Contractor accepts the terms, then he signs and returns it to the Owner's Representative.
  3. The Owner's Representative signs and forwards the authorization to the Owner for signature.
  4. If the Owner accepts the terms, then he signs and returns it to the Architect.
  5. The Architect signs all the originals, retains his original, and sends the Owner's representative, the Owner, and the Contractor (1) original each.

#### 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive through a web based construction management program selected by the Architect. Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. This section includes the following
  1. Forms
  2. Preparation of Schedule of Values
  3. Preparation of Application for Payment
  4. Other provisions pertaining to payments are included in Article 21 of the General Conditions.

#### 1.2 DEFINITIONS

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

#### 1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.
  2. All Contractors are to submit a detailed breakdown (schedule of values) of his costs for approval to the Architect. Breakdown shall be to a level of detail to expedite the reviewing process. The Construction Manager and the Architect reserve the right to direct a large breakdown.
  3. The schedule of values will be reviewed and adjured if necessary. Once approved the schedule of value is to be used for the AIA request for payment application. Only the AIA pay application forms will be recognized for billing purposes (AIA G702 CMA).
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.



1. Identification: Include the following Project identification on the schedule of values:
  - a. Project name and location.
  - b. Name of Architect and Construction Manager.
  - c. Architect's project number.
  - d. Contractor's name and address.
  - e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or Division.
  - b. Description of the Work.
  - c. Change Orders (numbers) that affect value.
  - d. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
    - 1) Labor.
    - 2) Materials.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  - a. Provide separate line items in the Schedule of Values for total cost associated with all Division 1 requirements. Refer to specification for submission requirements for each item:
    - 1) Bond cost
    - 2) Insurance
    - 3) Mobilization
    - 4) Submittals
    - 5) Schedule
    - 6) Safety (1% min.)
    - 7) Final Cleaning (1% min.)
    - 8) Job meeting attendance (1% min.)
    - 9) Retainage (5%)
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Submit Application for Payment to Architect by the 20<sup>th</sup> day of the month. The period covered by each Application for Payment is one month, ending on the 25<sup>th</sup> day of the month.
  1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702/CMA and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect and Construction Manager will return incomplete applications without action.
  1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
  - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
  - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
  - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
4. All deposits and prepayments are the responsibility of each contractor.
5. All funds will be dispersed by the Owner directly to the contractors.
6. A copy of partial waiver of Liens and Certified Payroll must accompany each application for payment.
7. Record Drawings will be reviewed on a monthly basis along with the pay application. Failure to maintain and up keep record drawings will impact the Contractor's pay request. All partial and final applications for payment shall include partial and final waivers respectively.

F. Changes in the Work

1. If Owner and Contractor are unable to agree on entitlement or in the amount or extent, if any, of an adjustment in the Contractor Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, the Contractor must notify the Construction Manager in writing stating the nature of the dispute and must, if so directed, proceed to complete the change on a time and material basis. Time and material tickets must be submitted daily for a signature by the Construction Manager within 24 hours of performing the work. No overhead or profit will be paid on additional wages paid for overtime work or standby work (contract work). Signed T & M tickets must be submitted for invoicing within 30 days after work is completed. All invoices are to include an itemized breakdown for material and labor. Submit T & M invoices for extra work to the Construction Manager.
2. Changes to the work cannot be billed until the Construction Manager issues a contract change order.
3. Markups on all changes shall be as set forth in this section.

G. Access to Accounting Records

1. The contractor shall check all materials, equipment and labor entering into the Work and shall keep such full and detailed accounts as may be necessary for proper financial management under this agreement and the system shall be satisfactory to the Owner. The Owner or Construction Manager shall be afforded access to all the Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda and similar data relating to the contract and the Contractor shall preserve all such records for a period of three years or for such longer period as may be required by law, after the final payment.

- H. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
- J. Initial Application for Payment: Administrative actions and submittals that MUST precede the first application for payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Combined contractor's construction schedule (preliminary if not final) incorporating work of multiple contracts, with indication of acceptance of schedule by each contractor.
  5. Products list (preliminary if not final)
  6. Schedule of unit prices.
  7. List of Contractor's staff assignments.
  8. List of Contractor's principal consultants.
  9. Copies of building permits.
  10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  11. Certificates of insurance and insurance policies.
  12. Performance and Payment bonds.
  13. Data needed to acquire Owner's insurance.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete, minus retainage and (2x) two times the value of work remaining, including punchlist items.
1. Include documentation supporting claim that Work is substantially complete and a statement showing an accounting of changes to the contract sum.
  2. This application shall reflect Certificate(s) of partial Substantial Completion issued previously for Owner occupancy of designated portions of the work.

L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with release and supporting documentation not previously submitted and accepted, including, but not limited to the Following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final Liquidated damages settlement statement.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01 2900

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on the Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project Web site.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

#### 1.2 DEFINITIONS

- A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.3 INFORMATIONAL SUBMITTALS

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

## 1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
  - 4. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.

## 1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.



10. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
  - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

#### 1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified through a web-based construction management program, Master Library.
  1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Name of Contractor.
  2. Name of Architect and Construction Manager.
  3. RFI number, numbered sequentially.
  4. RFI subject.
  5. Specification Section number and title and related paragraphs, as appropriate.
  6. Drawing number and detail references, as appropriate.
  7. Field dimensions and conditions, as appropriate.
  8. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  9. Contractor's signature.
  10. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: through a web based construction management program selected by the Architect.
  1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
  1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.

- d. Requests for coordination information already indicated in the Contract Documents.
  - e. Requests for adjustments in the Contract Time or the Contract Sum.
  - f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

#### 1.7 PROJECT WEB SITE – MASTER LIBRARY

- A. Use Master Library for purposes of hosting and managing project communication and documentation until Final Completion. Master Library shall include the following functions:
  - 1. Project directory.
  - 2. Project correspondence.
  - 3. Meeting minutes.
  - 4. Contract modification forms and logs.
  - 5. Schedule of values.
  - 6. RFI forms and logs.
  - 7. Task and issue management.
  - 8. Photo documentation.
  - 9. Schedule and calendar management.
  - 10. Submittal forms and logs.
  - 11. Field orders and requests for proposals.
  - 12. Change orders and logs.
  - 13. Jobsite reports.
  - 14. Punch lists
  - 15. Payment application forms.
  - 16. Drawing and specification document hosting, viewing, and updating.
  - 17. Online document collaboration.
  - 18. Reminder and tracking functions.
  - 19. Archiving functions.

#### 1.8 PROJECT MEETINGS

- A. General: Construction Manager will schedule meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

- C. Coordination Meetings: Construction Manager will conduct Project coordination meetings at biweekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Change Orders.
  3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

END OF SECTION 013100

## SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

### 1.1 SUMMARY

#### A. Section Includes:

1. Work sequence.
2. Contractor use of premises.
3. Owner occupancy.
4. Phasing Plan and Schedule
5. Site Safety & Logistics Drawings
6. Contractor's Responsibilities for Construction Schedule Development

#### B. Related Sections:

1. Section 01 1000: Summary of Work

### 1.2 WORK SEQUENCE

- A. General: The Work will be constructed under a single Prime Contractor Agreement. One set of Contract Documents is being issued covering the Prime Contract.
- B. All Work will be conducted in a number of continuous phases structured to minimize interference with the activities of the District's personnel and structured to permit the facilities to be occupied during construction and renovations at the existing school buildings. Work that has been phased for times other than the summer recess must be performed in a manner that minimizes interference with normal school operations in a manner that complies with the requirements of NYSED 155.5 "Unified Safety Standards for School Construction and Maintenance Projects".
- a. Each Prime Contractor is responsible for providing adequate manpower as needed throughout the course of the Project to maintain the overall construction schedule and milestone dates.
- C. **During Winter Break (12/24/2026-1/1/2027), February Break (2/15/2027-2/19/2027), Spring Break (3/29/2027-4/2/2027) & Summer Recess (6/28/2027-8/27/2027), Winter Break (12/20/2027-12/31/2027), February Break (2/21/2028-2/25/2028)\*, Spring Break (4/17/2028-4/21/2028)\* and Summer Recess (6/26/2028-9/1/2028) all work shall be performed 1st shift and 2<sup>nd</sup> shift from between the hours of 6:00 AM and 6:00 PM, Monday through Friday, unless otherwise authorized by the District and its agents in advance. All other work activities during the Academic School year shall be performed on 2<sup>nd</sup> shift. All contractors should plan that 50% of work will be required to be completed on 2<sup>nd</sup> shift or weekends at no additional cost to the District. All noisy work shall occur prior to student arrival at 7:30 AM or after student departure at 3:00 PM, 2<sup>nd</sup> Shift or weekends at no additional cost to the District.**
- a. \*The February 2028 and Spring Break 2028 are subject to change as the District will not solidify the school schedule until the end of 2027 school year.
  - b. The restrooms, Natatorium, & Library are available during the school year. All intrusive, loud work will be completed on breaks or 2<sup>nd</sup> shift. Any unintrusive, quiet work can be completed on 1<sup>st</sup> shift if approved by the District and Construction Manager.

- D. Unoccupied areas of existing buildings during school holidays and breaks shall generally be available for construction 24 hours daily. All work to be coordinated with and approved by the District through the Construction Manager. Activity and access shall be confined to the designated staging and construction areas. All exits and escape windows shall always be maintained. Activity in the staging area shall be conducted in a manner that causes minimal disruption to District operations. Any Work that requires disruption to existing building occupants, entries, exits, utilities, etc. shall be coordinated with and approved by the District through the Construction Manager.
- E. Start of workday where noise is generated and disruptive to adjoining neighborhoods, start time will be subject to local noise ordinances, with no costs for compliance to be passed onto the Owner. Contractors are subject to start and finish times of equipment in accordance with local noise ordinances, and contractors are responsible for associated costs and to maintain the construction schedule.
- F. All additional costs for overtime or second or third shift Work required by any Contractor to ensure Work completion in accordance with the project completion dates indicated in this section will be the responsibility of the Contractor.
- G. Each Bidder shall plan labor, materials (including long lead items), equipment and subcontractors as needed to complete Work in accordance with the project Construction Schedule, including punchlist completion. See the Phasing Schedule attached at the end of this specification for area specific completion requirements.
- H. Each Bidder shall review the Phasing Plan and Schedule located at the end of this section for milestone completion dates. Each contractor shall provide sufficient manpower, including extended hours, premium/multiple shifts hours, weekend, and holiday hours to assure that the work of each Prime Contractor is substantially complete in accordance with the milestone completion dates.
- I. Coordination:
  - 1. Schedule all construction activities at the Site through the Construction Manager to avoid interference with Owner's operations and to meet specified completion dates. It is the responsibility of all Prime Contractors to meet Completion Schedules within the Owner's Educational Schedule.
  - 2. Coordinate construction activities with the school calendar issued by Construction Manager to Prime Contractor to avoid interference with Owner's educational process and operations within building.
  - 3. Review Contract Document requirements in relationship to requirements for other Prime Contractors and Owner's Educational Schedule.
  - 4. Coordinate, through the Construction Manager, all interruptions of building services or shutdown of building systems and obtain, through the Construction Manager, written approval of proposed schedule for interruptions or shutdown from Owner.
  - 5. If, in Owner's opinion, any such interruption or shutdown will affect life safety of building occupants, schedule interruption or shut-down at time acceptable to Owner, at time when classes are not in session, or after normal working hours. Coordinate all such

changes through the Construction Manager. The Owner will not make extra payments for overtime outside normal working hours required by any such interruption or shutdowns. Prime Contractors requiring such overtime shall do so at their own cost and shall be responsible for extra costs incurred by other Prime Contractors as a result.

6. Ensure all equipment, fittings, pipe, and similar items required are on hand before interrupting or shutting-down existing systems.
7. Notify all inspectors and representatives of Utility Companies, Village Officials, Construction Manager, Architect, Owner, and similar parties by letter in advance of required changeovers, tie-ins, removals, and similar operations.
8. Construction Schedule: Construction shall be phased in accordance with the requirements of the Owner.
9. The General Trades Contractor (Contract #202) shall be responsible for coordinating ceiling removals for steel measurements and removal/installation with the District and Construction Manager over February and April breaks in 2026.
10. “Baking Out” Period: In Construction Schedule defined above for each Prime Contract; include at least 48 hours prior to occupancy of affected spaces for “baking out” and exhausting of volatile organic compounds (VOC) used during the construction period. Extend “baking out” period beyond 48 hours where manufacturers recommendations of any product installed in that area indicate a longer “baking out” period.
  - a. Comply with recommendations of manufacturer of all applicable produces regarding ventilation, heat, and similar measures required to ensure “baking out” complies with manufacturer’s requirements.
  - b. Products requiring “baking out” period include (but not limited to):
    - I. Finish materials applied to woodwork.
    - II. Adhesives
      - i. Used in applying woodwork to substrate or plastic laminate finishes to substrates.
      - ii. Used in applying membrane waterproofing to interior surfaces.
      - iii. Used in applying acoustical ceilings or wall treatments.
      - iv. Used in applying resilient tile, resilient sheet flooring, or resilient base and accessories.
      - v. Used in applying carpeting.
      - vi. Used in applying vinyl wall coverings.
    - III. Bituminous waterproofing products.
    - IV. Caulking and sealant products.
    - V. Epoxy grout in tile flooring.
    - VI. Finish materials used in applying finishes to wood flooring.

- VII. Release of emissions from carpet, vinyl wall coverings, curtains, (stage and window), vinyl-covered athletic equipment, upholstery materials, and similar materials.

### 1.3 CONTRACTOR USE OF PREMISES

- A. General: The Contractors shall limit their use of the premises to the Work areas indicated in the Contract Documents.
- B. Use of the Site: Limit use of the premises to Work areas indicated in the Contract Documents. Confine operations to areas within Contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
  - 1. Driveways and Entrances: At all times, keep driveways and entrances serving the premises clear and available to the District, the District's employees and emergency vehicles. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  - 2. Before the start of construction, Contractors will be directed to designated staging and parking area(s) as indicated on the Site Safety and Logistics plans.
- C. Use of Existing Buildings: Maintain the existing buildings in a serviceable and weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
- D. Access to Building - The Prime Contractor shall schedule all construction activities with Owner through Construction Manager to allow Owner's full use of building areas and systems for normal educational process.
  - 1. All work in or above corridors and occupied classrooms must be performed outside of school hours while school is in session.
  - 2. Owner acknowledges the Prime Contractor will require access to Owner occupied areas, rooms and systems, and intends to cooperate in making rooms and systems available for construction activities.
  - 3. Notify Construction Manager in advance of any requirements for access to any existing building outside normal working hours and days.
- E. Building Security: Owner will maintain building security at all times for his sole benefit. Each Prime Contractor retains full responsibility for security and protection of work of his prime contract until final acceptance by owner.
- F. Maintenance of Building Circulation and Exits: Maintain circulation corridors, exits and exit stairs unobstructed from equipment and materials, except in areas of construction activity enclosed by temporary partitions.

#### 1.4 OWNER OCCUPANCY

- A. Full District Occupancy: The District needs to occupy the completed facilities in the completion sequence described herein. The District will occupy the existing buildings during the normal school years while the project is under construction. The District will continue to occupy certain portions of the building during the summer recess of each calendar year for administrative offices and support service areas. Contractor work will be coordinated with the District through the Construction Manager to facilitate Contractor access to occupied areas during these summertime periods.
- B. Partial District Occupancy: The District reserves the right to occupy, and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work. Cooperate fully with the District or the District's Representative during construction operations to minimize conflicts and to facilitate District usage. Perform the Work so as not to interfere with the District's operation.
  - 1. Prior to partial District occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the District will operate and maintain mechanical and electrical systems serving occupied portions of the building.
  - 2. Upon occupancy, the District will assume responsibility for maintenance and custodial service for occupied portions of the building. The District will not clean up behind Contractors. Each Prime Contractor is responsible for cleaning up of debris caused by their construction activities.

#### 1.5 PHASING SCHEDULE AND PLAN

- A. Refer to the Phasing Schedule attachment at the end of this.

All items of work are not listed, phasing is intended to provide proposed guidelines for construction and indicate turnover dates to the Owner. These work areas have been established in cooperation with the Owner and have been coordinated to fit the needs of the district schedule. Every attempt must be made by Contractors and Subcontractors to facilitate the completion of defined work areas by the dates indicated. Note that work will be ongoing in non-specific work areas that are not indicated on the phasing plans, as needed to accomplish the project schedule.



B. Milestone Dates:

|                                                               |                   |
|---------------------------------------------------------------|-------------------|
| <b>Anticipated Notice to Proceed</b>                          | <b>10/21/2026</b> |
| <b>Restroom A103 &amp; A104 Substantial Completion</b>        | <b>06/18/2027</b> |
| <b>Restroom 174 &amp; 175 Substantial Completion</b>          | <b>06/18/2027</b> |
| <b>Restroom 250A &amp; 250B Substantial Completion</b>        | <b>06/18/2027</b> |
| <b>Natatorium Renovation Substantial Completion</b>           | <b>08/27/2027</b> |
| <b>Library Renovation (Summer 1) Substantial Completion</b>   | <b>08/27/2027</b> |
| <b>Mechanical Equipment Replacements (Summer 1)</b>           | <b>08/27/2027</b> |
| <b>Eagle Drive Sitework Substantial Completion</b>            | <b>08/27/2027</b> |
| <b>Front Entrance Ramp&amp; Stairs Substantial Completion</b> | <b>08/27/2027</b> |
| <b>Front Entrance Snowmelt System Substantial Completion</b>  | <b>10/01/2027</b> |
| <b>District Office Storefront</b>                             | <b>08/27/2027</b> |
| <b>Restroom 160 &amp; 161 Substantial Completion</b>          | <b>08/27/2027</b> |
| <b>Restroom 243 &amp; 244 Substantial Completion</b>          | <b>09/17/2027</b> |
| <b>Restroom 170 &amp; 171 Substantial Completion</b>          | <b>10/15/2027</b> |
| <b>Library Renovation (Summer 2) Substantial Completion</b>   | <b>08/25/2028</b> |
| <b>Mechanical Equipment Replacements (Summer 2)</b>           | <b>08/25/2028</b> |
| <b>Restroom 253 &amp; 254 Substantial Completion</b>          | <b>08/25/2028</b> |
| <b>Restroom 179 &amp; 179A Substantial Completion</b>         | <b>09/15/2028</b> |
| <b>All Other Scope Substantial Completion</b>                 | <b>08/25/2028</b> |
| <b>Final Contract Completion</b>                              | <b>11/24/2028</b> |

## 1.6 CONTRACTORS RESPONSIBILITIES FOR SCHEDULE DEVELOPMENT

Each Prime Contractor will take part in the preparation of a fully developed, horizontal bar-chart-type, construction schedule, prepared, maintained and updated by the Construction Manager.

- A. Each contractor will provide the tasks they wish to have indicated on the construction schedule and the appropriate durations, considering lead times to acquire material needed to complete indicated tasks. All elements of construction will require indication as a task.
- B. Each contractor will take part in meetings discussing task coordination, relationships, constraints, etc.
- C. Each Contractor will ensure the coordination and duration of tasks indicated for a specific phase of the project do not extend beyond the timeframes set forth in the Phasing Plans.
- D. Each Contractor will indicate what tasks will be performed on each specific shift of the workday.
- E. Each contractor will consider timeframes for “bake out” procedures, Architects review and preparation of punchlist, time for the contractors to complete punchlist, and time for the Owner to the secure Certificates of Occupancy if required. Architect's procedures necessary for certification of Substantial Completion.

## PART 2 - PRODUCTS

NOT USED

## PART 3 – EXECUTION

NOT USED

END OF SECTION

**LAKE SHORE CENTRAL SCHOOL DISTRICT**  
**2023 CAPITAL IMPROVEMENT PROJECT - PHASE 3 - MASTER CONSTRUCTION SCHDEULE**  
**SEPTEMBER 3, 2026**

| ID | Task Name                                              | Duration  | Start        | Finish       | % Complete | 202520262027202820292030                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----|--------------------------------------------------------|-----------|--------------|--------------|------------|--------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|    |                                                        |           |              |              |            |                                                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1  | LAKE SHORE CSD - CAPITAL IMPROVEMENT PROJECT - PHASE 3 | 999 days? | Mon 1/6/25   | Thu 11/2/28  | 22%        | LAKE SHORE CSD - CAPITAL IMPROVEMENT PROJECT - PHASE 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2  | PRE-CONSTRUCTION                                       | 339 days  | Mon 1/6/25   | Thu 4/23/26  | 100%       | PRE-CONSTRUCTION                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | BID & AWARD PHASE                                      | 65 days   | Thu 9/3/26   | Wed 12/2/26  | 0%         | BID & AWARD PHASE                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | DOCUMENTS AVAILABLE FOR BID                            | 1 day     | Thu 9/3/26   | Thu 9/3/26   | 0%         | DOCUMENTS AVAILABLE FOR BID                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | PRE-BID WALKTHROUGH                                    | 1 day     | Wed 9/9/26   | Wed 9/9/26   | 0%         | PRE-BID WALKTHROUGH                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | ADVERTISEMENT TO BIDDERS                               | 5 days    | Mon 9/21/26  | Fri 9/25/26  | 0%         | ADVERTISEMENT TO BIDDERS                               |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | RECEIVE AND TABULATE BIDS                              | 1 day     | Thu 10/1/26  | Thu 10/1/26  | 0%         | RECEIVE AND TABULATE BIDS                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | DESCOPE MEETINGS                                       | 2 days    | Fri 10/2/26  | Mon 10/5/26  | 0%         | DESCOPE MEETINGS                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17 | LETTER OF RECOMMENDATION TO BOE                        | 1 day     | Fri 10/9/26  | Fri 10/9/26  | 0%         | LETTER OF RECOMMENDATION TO BOE                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 | BOE APPROVE CONTRACTS                                  | 1 day     | Tue 10/20/26 | Tue 10/20/26 | 0%         | BOE APPROVE CONTRACTS                                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 | ANTICIPATED NOTICE TO PROCEED                          | 1 day     | Wed 10/21/26 | Wed 10/21/26 | 0%         | ANTICIPATED NOTICE TO PROCEED                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | BONDS/INSURANCE/SUBMITTALS                             | 30 days   | Thu 10/22/26 | Wed 12/2/26  | 0%         | BONDS/INSURANCE/SUBMITTALS                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 21 | CONSTRUCTION PHASE                                     | 449 days? | Mon 12/28/26 | Fri 9/15/28  | 0%         | CONSTRUCTION PHASE                                     |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 22 | HIGH SCHOOL BUILDING                                   | 449 days? | Mon 12/28/26 | Fri 9/15/28  | 0%         | HIGH SCHOOL BUILDING                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 23 | RESTROOMS A103 & A104 (DISTRICT OFFICE)                | 78 days   | Mon 12/28/26 | Wed 4/14/27  | 0%         | RESTROOMS A103 & A104 (DISTRICT OFFICE)                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | Build Temporary Partition                              | 2 days    | Mon 12/28/26 | Tue 12/29/26 | 0%         | Build Temporary Partition                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | Demo                                                   | 5 days    | Wed 12/30/26 | Tue 1/5/27   | 0%         | Demo                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 | Frame New Wall                                         | 1 day     | Wed 1/6/27   | Wed 1/6/27   | 0%         | Frame New Wall                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27 | MEP Rough In                                           | 15 days   | Thu 1/7/27   | Wed 1/27/27  | 0%         | MEP Rough In                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 | Frame & Drywall Ceiling and Wall                       | 10 days   | Thu 1/28/27  | Wed 2/10/27  | 0%         | Frame & Drywall Ceiling and Wall                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 29 | Quarry Tile Floor                                      | 10 days   | Thu 2/11/27  | Wed 2/24/27  | 0%         | Quarry Tile Floor                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | Wall Tile                                              | 20 days   | Thu 2/25/27  | Wed 3/24/27  | 0%         | Wall Tile                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 31 | Install Lights                                         | 5 days    | Thu 2/11/27  | Wed 2/17/27  | 0%         | Install Lights                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | Install Plumbing Fixtures                              | 10 days   | Thu 3/25/27  | Wed 4/7/27   | 0%         | Install Plumbing Fixtures                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 33 | Toilet Partitions & Accessories                        | 5 days    | Thu 4/8/27   | Wed 4/14/27  | 0%         | Toilet Partitions & Accessories                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | RESTROOMS 174/175/250A/250B (STAFF)                    | 155 days  | Mon 12/28/26 | Fri 7/30/27  | 0%         | RESTROOMS 174/175/250A/250B (STAFF)                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35 | Build Temporary Partition                              | 5 days    | Mon 12/28/26 | Fri 1/1/27   | 0%         | Build Temporary Partition                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | Demo                                                   | 10 days   | Mon 1/4/27   | Fri 1/15/27  | 0%         | Demo                                                   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 37 | Frame Walls                                            | 5 days    | Mon 1/18/27  | Fri 1/22/27  | 0%         | Frame Walls                                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | MEP Rough In                                           | 25 days   | Mon 1/25/27  | Fri 2/26/27  | 0%         | MEP Rough In                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 | Frame & Drywall Ceiling and Wall                       | 15 days   | Mon 3/1/27   | Fri 3/19/27  | 0%         | Frame & Drywall Ceiling and Wall                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | Quarry Tile Floor                                      | 20 days   | Mon 3/22/27  | Fri 4/16/27  | 0%         | Quarry Tile Floor                                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 41 | Wall Tile                                              | 25 days   | Mon 4/19/27  | Fri 5/21/27  | 0%         | Wall Tile                                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 | Install Lights                                         | 5 days    | Mon 3/22/27  | Fri 3/26/27  | 0%         | Install Lights                                         |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 43 | Install Plumbing Fixtures                              | 15 days   | Mon 5/24/27  | Fri 6/11/27  | 0%         | Install Plumbing Fixtures                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44 | Toilet Partitions & Accessories                        | 5 days    | Mon 6/14/27  | Fri 6/18/27  | 0%         | Toilet Partitions & Accessories                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45 | LIBRARY RENOVATION (SUMMER 1)                          | 139 days  | Mon 2/15/27  | Fri 8/27/27  | 0%         | LIBRARY RENOVATION (SUMMER 1)                          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 | Install Temporary Partition                            | 5 days    | Mon 2/15/27  | Fri 2/19/27  | 0%         | Install Temporary Partition                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 47 | Demo (2nd shift)                                       | 15 days   | Mon 2/22/27  | Fri 3/12/27  | 0%         | Demo (2nd shift)                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 48 | Framing Rough In                                       | 10 days   | Mon 3/15/27  | Fri 3/26/27  | 0%         | Framing Rough In                                       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 49 | MEP Rough In                                           | 15 days   | Mon 3/22/27  | Fri 4/9/27   | 0%         | MEP Rough In                                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50 | Install Door Frames                                    | 3 days    | Mon 3/29/27  | Wed 3/31/27  | 0%         | Install Door Frames                                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 51 | Drywall                                                | 20 days   | Mon 4/12/27  | Fri 5/7/27   | 0%         | Drywall                                                |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 52 | Wrap Existing Columns                                  | 10 days   | Mon 4/12/27  | Fri 4/23/27  | 0%         | Wrap Existing Columns                                  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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[illegible]

| LAKE SHORE CENTRAL SCHOOL DISTRICT                                        |           |          |       |        |          |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---------------------------------------------------------------------------|-----------|----------|-------|--------|----------|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 CAPITAL IMPROVEMENT PROJECT - PHASE 3 - MASTER CONSTRUCTION SCHDEULE |           |          |       |        |          |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| SEPTEMBER 3, 2026                                                         |           |          |       |        |          |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| ID                                                                        | Task Name | Duration | Start | Finish | % Comple | 2025 |   |   |   |   |   |   |   |   |   |   |   | 2026 |   |   |   |   |   |   |   |   |   |   |   | 2027 |   |   |   |   |   |   |   |   |   |   |   | 2028 |   |   |   |   |   |   |   |   |   |   |   | 2029 |   |   |   |   |   |   |   |   |   |   |   | 2030 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                                                                           |           |          |       |        |          | M    | J | J | A | S | O | N | D | J | F | M | A | M    | J | J | A | S | O | N | D | J | F | M | A | M    | J | J | A | S | O | N | D | J | F | M | A | M    | J | J | A | S | O | N | D | J | F | M | A | M    | J | J | A | S | O | N | D | J | F | M | A | M    | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F |





## CAPITAL IMPROVEMENT PROJECT - PHASE 3

013200.2 - CONSTRUCTION  
PROGRESS DOCUMENTATION

HIGH SCHOOL 1ST FLOOR  
PHASING PLAN

**LAKE SHORE  
SCHOOL DISTRICT  
HIGH SCHOOL**

**959 BEACH ROAD  
ANGOLA, NY 14006**

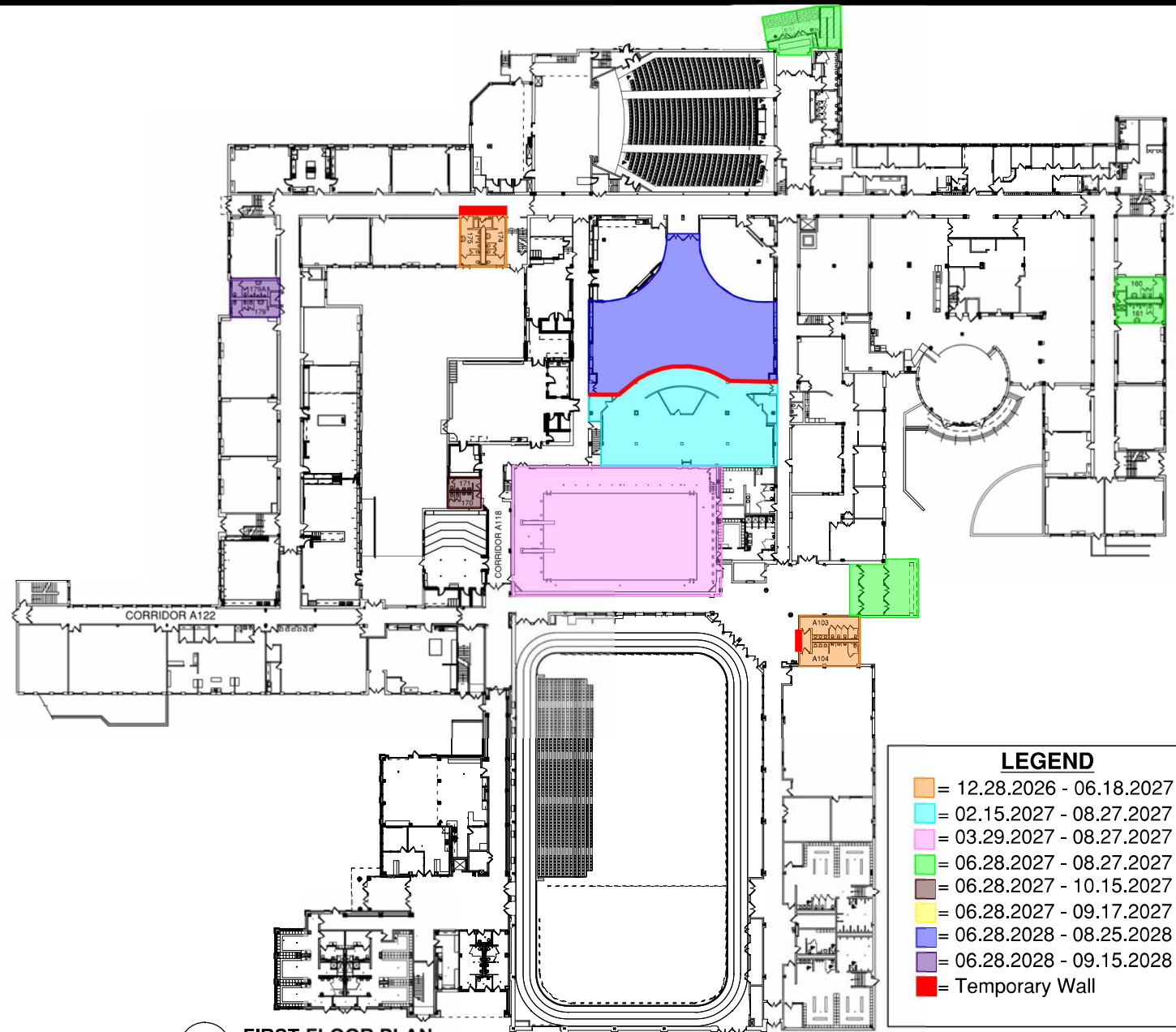
### GENERAL NOTES:

1. The intent of phased construction plans is to depict approximate extents of areas of renovation that require coordination with multiple trades and building occupants. Refer to contract documents for extents of all work scope, as all scope is not shown on phased construction plans.

2. This document uses color to depict different areas of renovation. If you are viewing a B&W version, please contact the planroom or planhouse from which the prints were obtained.

3. Reference 013200 - Construction Progress Documentation for schedule information.

4. Reference 01 5000 - Temporary Facilities and Controls for Construction of Temporary Phasing Walls / Barriers.



### LEGEND

- Orange = 12.28.2026 - 06.18.2027
- Cyan = 02.15.2027 - 08.27.2027
- Pink = 03.29.2027 - 08.27.2027
- Green = 06.28.2027 - 08.27.2027
- Brown = 06.28.2027 - 10.15.2027
- Yellow = 06.28.2027 - 09.17.2027
- Blue = 06.28.2028 - 08.25.2028
- Purple = 06.28.2028 - 09.15.2028
- Red = Temporary Wall

1

**FIRST FLOOR PLAN**  
Scale: 1" = 50'-0"



## CAPITAL IMPROVEMENT PROJECT - PHASE 3

013200.2 - CONSTRUCTION  
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HIGH SCHOOL 1ST FLOOR  
PHASING PLAN

**LAKE SHORE  
SCHOOL DISTRICT  
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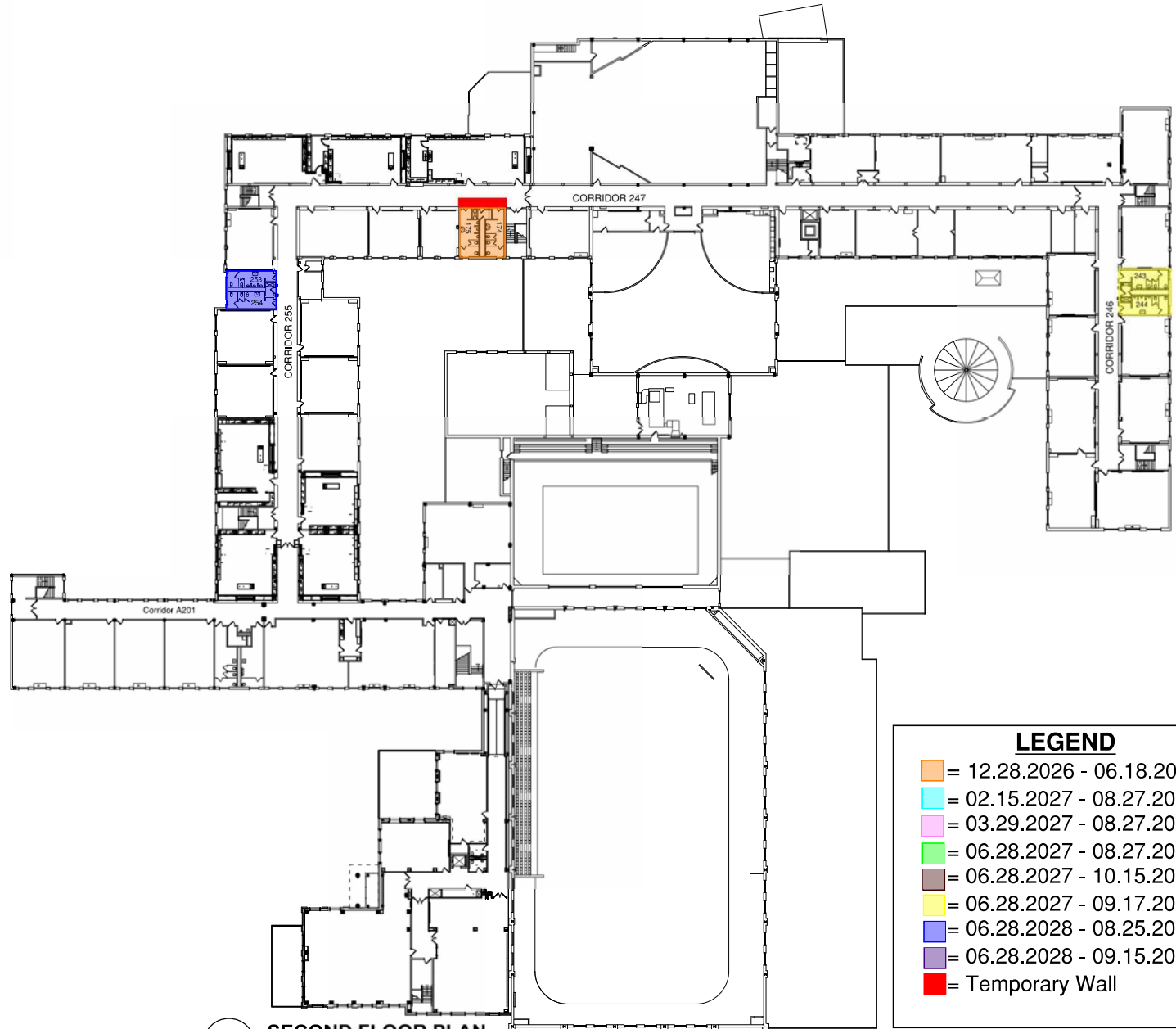
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- = 06.28.2027 - 09.17.2027
- = 06.28.2028 - 08.25.2028
- = 06.28.2028 - 09.15.2028
- = Temporary Wall

1

### SECOND FLOOR PLAN

Scale: 1" = 50'-0"



## SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.

### PART 2 - PRODUCTS

#### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in file name for each image.
  - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Construction Manager.
- C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and Construction Manager.

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

#### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### 1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.

- f. Scheduled date for Architect's final release or approval.
- g. Scheduled date of fabrication.

#### 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  - 3. Resubmittal Review: Allow 14 days for review of each resubmittal.
  - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
  - 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
  - 6. All color selection submittals and samples for interior finish must be received prior to commencement of the Architect's review. The 21 day review period will begin once the final color selection submittal has been received.
- C. Electronic Submittals: Provide submittals via the Project Website. Identify and provide information requested in each field of the electronic submittal.
- D. Options: Identify options requiring selection by Architect.
- E. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents,

including minor variations and limitations. Include same identification information as related submittal.

- F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.

- e. Testing by recognized testing agency.
  - f. Application of testing agency labels and seals.
  - g. Notation of coordination requirements.
  - h. Availability and delivery time information.
- 4. For equipment, include the following in addition to the above, as applicable:
  - a. Wiring diagrams showing factory-installed wiring.
  - b. Printed performance curves.
  - c. Operational range diagrams.
  - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Submit Product Data in the following format:
  - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit electronic Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 18 by 24 inches. Shop Drawings larger than 18 by 24 inches are to be submitted in hard copy format; 2 copies.
  - 3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.

- d. Number and title of applicable Specification Section.
  - e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit one (1) set of Samples. Architect will retain one Sample as the project record sample and include samples on the final room finishes presentation board that will either be displayed by the District and/or used in the job trailer for quality control reference during the project.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party for review.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

## SECTION 01 4000 – QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Related Sections include the following:
  - 1. Division 1 Section 01 3100 "Project Management and Coordination" specifies requirements for development of a schedule of required tests and inspections.
  - 2. All contractors are required to provide submittals in accordance with the contract documents. In many cases the technical specification for each submittal requires a NYS Certified Engineered drawing or calculations.
- F. Related References:
  - 1. American Society for Testing and Materials (ASTM)
    - a. ASTM 3740 (1985) Evaluation of Agencies engaged in the testing and or inspections of soil and rock as used in Engineering Design and Construction.
    - b. ASTM E 329 (1990) use the Evaluation of Testing and Inspection Agencies as used in construction.



G. This section includes the following:

1. Responsibilities.
2. Quality Control Plan.
3. Content of the CQC Plan.
4. Quality Control Organization.
5. Submittal.
6. Control.
7. Testing.
8. Completion Inspection.
9. Documentation.
10. Quality Control Report Forms.

## 1.02 RESPONSIBILITIES

- A. Each Prime Contractor and all Sub-Contractors are responsible for the quality control of the project and shall establish and maintain an effective Quality Control system in compliance with the contract documents. The Quality Control system shall consist of a plan, an organization, and procedures necessary to produce an end product, which complies with the contract requirements. The Quality Control system shall cover all construction operations, both on and off site and shall be keyed to the Milestone Construction Schedule. The quality control program shall be included in the cost of the bid. Separate payments will not be made for providing and maintaining an effective Quality Control Program.
- B. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
  2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services. However, it is the contractors' responsibility to schedule the testing agency in advance to any work being performed requiring testing.

- C. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- D. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
1. Provide access to the Work.
  2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
  3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
  4. Provide facilities for storage and curing of test samples.
  5. Deliver samples to testing laboratories.
  6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  7. Provide security and protection of samples and test equipment at the Project Site.
- E. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect/CM and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
  3. The agency shall not perform any duties of the Contractor.

- F. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
  - 1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities. Notify the construction manager when contractor required tester/inspector arrives at project site and when special tests/inspections are to take place.
  - 2. Inform the construction manager at least 48 hours prior to the need for owner employed independent testing agency.

#### 1.03 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect/CM. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
  - 1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  - 2. Report Data: Written reports of each inspection, test, or similar service shall include, but are not limited to, the following:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address, and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making the inspection or test.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.
    - i. Test results and an interpretation of test results.
    - j. Ambient conditions at the time of sample taking and testing.
    - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    - l. Name and signature of laboratory inspector.
    - m. Recommendations on retesting.

#### 1.04 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: As indicated in individual sections.
  - 1. Where no specific qualifications are specified, use only experienced manufacturers.
  - 2. Where qualifications are required to be submitted but no specific qualifications are specified, use only experienced manufacturers.

3. The term "experienced," unless otherwise indicated, means having 5 years of successful production of products similar to those to be used on this project.
- B. Qualifications of Installers: As indicated in individual sections.
1. Where no specific qualifications are specified, use only experienced installers.
  2. Where qualifications are required to be submitted but no specific qualifications are specified, use only experienced installers.
  3. The term "experienced," unless otherwise indicated, means having satisfactorily completed similar work on 10 projects of similar scope and complying with applicable requirements of governing authorities.
- C. Qualifications of Design Engineering Personnel: As indicated in individual sections; if not indicated, provide services of a professional engineer licensed in the State of New York.
- D. Qualifications of Manufacturers' Field Personnel: Employed directly by the manufacturer and normally performing the activities specified.
- E. Qualifications of Testing and Inspection Personnel:
1. Except as otherwise indicated in individual Sections, and except where manufacturer's testing facilities are indicated as acceptable, engage independent testing laboratories specializing in required services and comply with "Recommended Requirements for Independent Laboratory Qualification" by American Council of Independent Laboratories (ACIL).
  2. Independent Testing Agency Qualifications: When employed by the Contractor:
    - a. A firm independent from the Contractor's organization.
    - b. Having experience in the testing specified, and having the capability to conduct satisfactorily the testing specified without delaying the progress of the work, as shown by information supplied as required by ASTM E 699.
    - c. Authorized to conduct business in the State of New York.
  3. Where the Owner has employed a testing agency to test or inspect a portion of the work, and the Contractor also is required to employ a testing agency for the same or a related element, do not employ the same testing agency the Owner has employed, unless otherwise agreed upon in writing.
- F. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards (NBS) standards or to accepted values of natural physical constants.

## 1.05 SEQUENCING AND SCHEDULING

- A. Schedule for Quality Control Activities: Prepare a schedule for quality control activities required. Submit as part of the Contractor's construction schedule.
  - 1. Provide the following information for each activity:
    - a. Specification section number.
    - b. Description of activity.
    - c. Starting time of activity.
    - d. Elapsed time required for activity.
    - e. The date that the work will be ready for the Owner's testing agency access.
    - f. Entity responsible.
  - 2. Distribute to:
    - a. The Owner.
    - b. The Architect.
    - c. The Construction Manager.
    - d. Each entity performing work for which quality control activities are specified.
- B. Coordinate quality control activities to avoid delay and to make it unnecessary to uncover work for testing or inspection.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Provide work of the specified quality; where quality level is not indicated, provide work of quality customary in similar types of work.
  - 1. Where codes, laws, or regulations require work of higher quality or performance, provide work complying with those codes, laws, and regulations.
  - 2. Where two or more quality provisions of the contract documents conflict, comply with the most stringent requirement; where requirements are different but apparently equal, and where it is uncertain which requirement is most stringent, obtain clarification from the Architect before proceeding.
- B. Where the Contractor is required to complete the design, use accepted methods and procedures resulting in work of the specified quality.
- C. Control products, suppliers, manufacturers, site conditions, installers, and workmanship in such a manner as to produce work of the specified quality.

- D. Comply with manufacturers' instructions and recommendations.
  - 1. Keep a record of instructions and recommendations which supplement or conflict with the manufacturer's written instructions.
  - 2. When manufacturers' instructions and recommendations conflict with the contract documents, obtain clarification from the Architect before proceeding.
- E. Use installers who are capable of producing work of the specified quality.
- F. Perform all quality control activities specified unless indicated to be performed by other entities.

### 3.02 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

### 3.03 QUALITY CONTROL PLAN

- A. The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Construction Manager will consider an interim plan for the first 15 days of operation. Construction will be permitted to begin only after acceptance of the Contractor Quality Control (CQC) Plan or acceptance of an interim plan, applicable to the particular features of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started. The Quality Control Plan must be submitted immediately upon award of the contract.
- B. The content of the CQC Plan shall include as a minimum, the following, to cover all construction operations, both on and off site including work by subcontractors, fabricators, and supplier's and purchasing agents.
  - 1. A description of the Quality Control organization including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The Contractor organization shall include a CQC Manager who shall report to the Project Manager or someone higher in the contractor's organization.

2. The name, qualifications (in resume format), duties, responsibilities, and authority of each person assigned CQC function.
3. Procedures for the evaluation of work in place on a daily basis. Identify area, floor, column lines, scheduled tolerances, and installed tolerances.
4. A letter generated by an authorized official of the Contractor organization, which describes the responsibilities and delegated such efficient authorities to adequately perform the functions of the CQC Manager. The CQC Manager shall issue letters of direction to all other various Quality Control Representatives outlining duties, authorities, and responsibilities.
5. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off site fabricators, suppliers, and purchasing agents.
6. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring the test, feature of work to be tested, test frequency, and person responsible for each test.
7. Procedures for tracking preparatory, initial, and follow up Control Phase and Control Verification, and acceptance test's including documentation.
8. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
9. Quality Control report is to be submitted monthly, concurrently with the Application for Payment.
10. Reporting procedures, including proposed reporting forms, and a list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has a separate control requirements. Although each section of the specification may generally be considered as a definable feature of work. There is frequently more work than one definable feature under a particular section.

#### 3.04 ACCEPTANCE OF PLAN

- A. Acceptance by the Architect of the Contractor's Plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction.

#### 3.05 MODIFICATION OF CHANGES

- A. After acceptance of the Quality Control Plan, the Contractor shall notify the Construction Manager in writing a minimum of five (5) working days prior to any proposed change. The Contractor shall meet with the Construction Manager or authorized representative and discuss the Contractor Quality Control system. During the meeting a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, and administration of the system for both on site and off site work. Minutes of the meeting shall be prepared by the Construction Manager and signed by both the Construction Manager and the Contractor. The meeting minutes shall then become part of the contract documents.

### 3.06 QUALITY CONTROL ORGANIZATION

- A. CQC System Organization: The Contractor shall identify an individual within the organization who shall be responsible for overall management of CQC and have the authority to act on all matters for the Contractor. An alternate for the CQC system management will be identified in the plan to serve in the event of the QC Manager's absence.
- B. CQC Staff: The following are the minimum requirements for the CQC staff. The actual strength of the CQC staff may vary during any specific work period to cover the needs of the work. When necessary for a proper CQC organization the Contractor will add additional staff at no cost to the Owner / Architect. This listing of the minimum staff in no way relieves the Contractor of meeting the basic requirements of Quality Construction in accordance with contract requirements.
- C. CQC Manager: The CQC Manager shall be an experienced construction person with a minimum of five (5) years experience in related work. The CQC Manager shall be assigned as System Manager, but may have duties as Project Superintendent in addition to Quality Control.
- D. Supplemental Personnel: A staff shall be maintained under the direction of the CQC Manager to perform all QC activities. The staff must be of sufficient size to ensure adequate QC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities. The staff must also be allowed sufficient time to carry out these responsibilities. The QC plan will clearly state the duties and responsibilities of each staff member.
- E. QC Organization Changes: The Contractor shall notify the Construction Manager in writing before replacing any member of the CQC staff. Requests shall include the name, qualifications, duties, and responsibilities of each proposed replacement.
- F. Submittals: Submittals shall be made in accordance with Section 013300 "Submittal Procedures". The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract documents.
- G. Control: Contractor Quality Control is the means by which the Contractor ensures the construction, to include that the subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both on site and off site fabrication and will be keyed to the proposed construction schedule. The control shall include at least three phases of control to be completed by the CQC Manager for all definable features of work as follows.



### 3.07 PREPARATORY PHASE

- A. This phase shall be performed prior to beginning work on each definable feature of work and shall include:
  - 1. A review of each paragraph of applicable specifications.
  - 2. A review of the contract plans.
  - 3. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
  - 4. A check to assure that provisions have been made to provide required control inspection and testing.
  - 5. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
  - 6. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
  - 7. Reviews of the appropriate activity hazard analysis to assure safety requirements are met.
  - 8. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerance and workmanship standards for that phase of work.
  - 9. A meeting conducted by the CQC Manager and attended by the Superintendent / Foremen and applicable CQC personnel responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC Manager and attached to the daily QC report.

### 3.08 INITIAL PHASE

- A. This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:
  - 1. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.
  - 2. Verification of full contract compliance. Verify required control inspection and testing.
  - 3. Establish a level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
  - 4. Resolve all differences.
  - 5. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
  - 6. The Construction Manager shall be notified at least 24 hours in advance of beginning the initial phase. Separate meeting minutes of this phase shall be prepared by the CQC system manager and attached to the daily QC report. Exact location of the initial phase shall be indicated for future reference and comparison with follow up phases.
  - 7. The initial phase should be repeated for each new crew to work on site, or any time acceptable specified quality standards are not met.

### 3.09 FOLLOW-UP PHASE

- A. Daily checks and reporting shall be performed by the Contractor to assure a continuing compliance with contract requirements, including control testing until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work.

### 3.10 ADDITIONAL PREPARATORY AND INITIAL PHASES

- A. Additional preparatory and initial phase are to be conducted on the same definable features of work as determined by the Construction Manager if the quality of work, on going, is on acceptable as if work on a definable feature is resumed after a substantial period of inactivity or if other problems develop.

### 3.11 TESTING

- A. The District will employ an outside testing agency to monitor soil compaction, concrete quality, and steel bolt connections. The Contractors shall pay all other fees and perform specified or required tests to verify that control measures are adequate to provide a product that conforms to contract requirements. Testing includes operation and/or acceptance test when specified. The Contractor shall produce the services of an approved testing laboratory or establish an approved testing laboratory at the project site. A list of tests to be performed shall be furnished as part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of testing, and an estimate of the number of tests required. The Contractor shall perform the following activities, record, and provide the following data:
  - 1. Verify that testing procedures comply with contract requirements.
  - 2. Verify that facilities and testing equipment are available and comply with testing standards.
  - 3. Check test instrument calibration data against certified standards.
  - 4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
  - 5. Results of all tests taken, both passing and failing results, will be recorded on the Quality Control report for the date taken, specification paragraph reference, location where tests were taken, and the sequential control number identifying the test that will be given. Actual test reports may be submitted later, if approved by the Construction Manager, with reference to the test number and date taken. An informational copy of the tests performed by an off site or commercial test facility will be provided directly to the Construction Manager. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this project.

### 3.12 COMPLETION INSPECTION

- A. At the completion of all work or any, increment thereof established by a completion time stated in the Specification section of the solicitation, entitled or stated elsewhere in the specifications. The CQC system manager shall conduct an inspection of the work and develop a "Punch List" of items, which do not conform to approved plans and specifications. Such a list of deficiencies shall be included in that CQC documentation, and shall include the estimated date by which the deficiencies will be corrected and so notify the Construction Manager.

### 3.13 DOCUMENTATION

- A. The Contractor shall maintain current records of quality control operations, activities, and tests performed, including the work of subcontractors and suppliers. These records shall be submitted on a monthly basis. These records shall be on an acceptable form to the Construction Manager and shall include factual evidence that required Quality Control activities and/or tests have been performed, including but not limited to the following:
  - 1. Contractor / Subcontractor compliance with the contract documents.
  - 2. Work performed daily, giving location, description, and by whom. Inspections, tests and/or control activities performed with results and referenced to specifications / plan requirements. The control phase should be identified (Preparatory, Initial, and Follow-up). List deficiencies noted along with corrective action.

### 3.14 MODIFICATION OF NON-COMPLIANCE

- A. The Construction Manager will notify the Contractor of detected non-compliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Construction Manager may invoke District remedies including an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to deficiency reporting or stop orders shall be the subject of claim for extension of time or for extra cost or damage by the Contractor. Progress payments shall not be approved nor processed until such time that the deficiency has been corrected to the satisfaction of the architect.

**END OF SECTION 014000**

## SECTION 014100 – SPECIAL INSPECTIONS & TESTING

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. This specification section is intended to inform the Contractor of the Owner's quality assurance program and describe the extent of the Contractor's responsibilities regarding the program. This specification section is also intended to notify the Special Inspector, Testing Laboratories and other Agents of the Special Inspector of their requirements and responsibilities.
- B. The owner will engage the services of a qualified Special Inspector / Special Inspections Coordinator for this project who will provide and/or coordinate testing and inspection requirements in accordance with the provisions of chapter 17 of the “Building Code of New York State”, the project statement of special inspections and all associated notes provided on the contract documents.

#### 1.2 STATEMENT AND SCHEDULE OF INSPECTIONS AND TESTS

- A. Individual material specification sections, the schedule of special inspections and all associated notes on the contract documents describe the structural testing and inspections required for the project. Collectively they shall be considered the “Statement of Special Inspections”.
- B. The Engineer of Record (EOR) will prepare the Statement and Schedule of Special Inspections and Testing.
- C. The Statement and Schedule of Special Inspections and Testing will be submitted with the application for the Building Permit.

#### 1.3 QUALIFICATIONS

- A. The Special Inspector/Special Inspections Coordinator shall be a qualified Professional Engineer, hired directly by the Owner, who demonstrates competence to the satisfaction of the Construction Manager, Building Official, and Engineer of Record.
- B. The testing agencies shall retain the services of a full time registered Professional Engineer who shall certify all test reports. This Engineer shall be in responsible charge of the field and laboratory testing operations.
- C. Special inspections shall be performed by the Special Inspector and/or testing agencies who are certified as described in the schedule of special inspections and meet the minimal qualifications of the Building Code of New York State, Chapter 17.

#### 1.4 SUBMITTALS

- A. The Special Inspector and Testing Laboratories shall submit for record a copy of their qualifications, which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.
- B. The Special Inspector and Testing Laboratories shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.
- C. Copies of all submittals, statements, logs and reports, including the Final Report, shall be distributed by the Special Inspector and Testing Agencies as follows:
  - 1. Owner one copy
  - 2. Building Official one copy
  - 3. Construction Manager one copy
  - 4. Contractor or material supplier one copy
  - 5. Architect one copy
  - 6. Structural Engineer of Record one copy

#### 1.5 CONTRACTOR RESPONSIBILITIES

- A. The contractor shall cooperate with the Special Inspector and Testing Agencies including safe access to the work areas so that all inspections and testing may be performed in a timely manner, without hindrance or undue delay to the project.
- B. The contractor shall hold a pre-construction meeting prior to the start of construction to discuss the required testing, inspection, notification and reporting procedures. Attendees shall include the following:
  - 1. Owner or Owner's representative
  - 2. Special Inspector / Special Inspections Coordinator
  - 3. Testing Agencies
  - 4. Contractor and affected Sub-Contractors
- C. The contractor shall review the lists of Special Inspections and Testing and be responsible for coordinating and scheduling inspections and tests. Notify the Special Inspectors or Testing Laboratories at least 24 hours in advance of a required inspection or test. Un-inspected work that requires inspection may be rejected solely on that basis.
- D. Retain the latest set of construction drawings, field sketches, reviewed shop drawings and specifications at the project site for use by the inspectors and testing technicians.
- E. The cost of any retesting or re-inspection of work which fails to comply with the requirements of the Contract Documents is the responsibility of the Contractor.
- F. The Special Inspection program does not, in any way, relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents, or from implementing an effective Quality Control program. All work that is to be subjected to Special Inspections shall first be reviewed by the Contractor's quality control personnel.

- G. The contractor has the sole responsibility for construction site safety.

#### 1.6 LIMITS ON AUTHORITY

- A. The Special Inspector or Testing Laboratories may not release, revoke, alter or enlarge on the requirements of the contract documents without specific written approval of the Owner or Engineer of Record.
- B. The Special Inspector or Testing Laboratories will not have control over the Contractor's means and methods of construction.
- C. The Special Inspector or Testing Laboratories are not responsible for construction site safety.
- D. The Special Inspector or Testing Laboratories have no authority to stop the work.

#### 1.7 RECORDS AND REPORTS

- A. Submit interim reports at a frequency noted in the schedule of special inspections for each inspection or test. Reports shall include the following:
  - 1. Date of test or inspection.
  - 2. Name of inspector or technician.
  - 3. Location of specific areas of the project inspected or tested.
  - 4. Description of test or inspection, and results of same.
  - 5. Applicable ASTM or test standard.
  - 6. Weather conditions at time of test or inspection.
  - 7. Signature of special inspector or technician performing test or inspection.
- B. The Special Inspector and each Testing Agency shall produce and update a log to record and track non-conforming work during construction. The updated non-conformance log shall be submitted on a weekly basis and contain the following information:
  - 1. Date of non-conforming work.
  - 2. Description of non-conforming work.
  - 3. If provided, response from Engineer of Record regarding non-conforming work.
  - 4. Status of non-conforming work – “open” or “closed”
- C. The Special Inspector and/or Testing Agency shall immediately notify the contractor of deficient work that required corrective action. Inspection reports for this work shall note when and how the deficient work was corrected. Work immediately corrected with Special Inspector or Testing Agency present and re-inspected or tested need not be identified as non-conforming work.
- D. Deficient work, not immediately corrected while Special Inspector or Testing Agency are on site, shall be reported to the Engineer of Record and Code Enforcement Official within 24 hours. A report of non-conformance shall be issued for this work.
- E. Provide a statement at the completion of each material work (i.e. concrete, steel etc.) requiring

Special Inspections from the Special Inspector and each testing agency that the work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed. Final non-conforming log for each material shall be submitted at this time.

#### 1.8 FINAL REPORT OF SPECIAL INSPECTIONS

- A. Each Testing Agency shall submit, stamp and sign an Agent's Final Report to the Special Inspector for attachment to the Special Inspector's Final Report. The Final Report shall be stamped and signed by the Special Inspector and submitted to the Code Enforcement Official and Owner prior to the issuance of a Certificate of Use and Occupancy.
- B. The Agent's Final Report and Special Inspector's Final Report shall indicate all inspections performed, reports of non-conforming work and status of non-conforming work. Non-Conforming work not corrected at substantial completion of the structure shall be highlighted in the Final Report for the Code Enforcement Official's review.

END OF SECTION 014100

## SECTION 014200 - REFERENCES

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

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

#### 1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.



1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

## SECTION 014500 – SAFETY STANDARDS FOR SCHOOL CONSTRUCTION AND MAINTENANCE PROJECTS

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. This section includes the following safety standards as established under (8 NYCRR 155.5 regulations)
  - 1. Certificate of Occupancy
  - 2. Safety and Security Standards for Construction Project
  - 3. Separation of Construction Areas
  - 4. Exiting and Ventilation
  - 5. Fire and Hazard Protection
  - 6. Construction Noise
  - 7. Construction Fume Control and Off-Gassing
  - 8. Asbestos Abatement
  - 9. Lead Abatement

#### 1.2 CERTIFICATE OF OCCUPANCY

- A. All prime contractors shall comply with the minimum requirements necessary to maintain a certificate of occupancy for all portions of existing buildings under construction that are to remain occupied during construction.

#### 1.3 SAFETY AND SECURITY STANDARDS FOR CONSTRUCTION PROJECTS:

- A. All prime contractors shall store all construction materials in a safe and secure manner.
- B. Fences around construction supplies or debris shall be maintained.
- C. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
- D. During exterior renovation work, overhead protection shall be provided for any sidewalks or area immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry
- E. At the discretion of the Owner, workers shall be required to wear photo-identification badges at all times for identification and security purposes while working at occupied sites.

#### 1.4 SEPARATION OF CONSTRUCTION AREAS

- A. General trades contractors to provide separation of construction areas from occupied spaces. Construction areas, which are under the control of a contractor and therefore not occupied by district staff or students, shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated

separation. Heavy-duty plastic sheeting may be used only for a vapor, fine dust or air infiltration barrier and shall not be used to separate occupied spaces from construction areas.

1. A specific stairwell and/or elevator should be assigned for construction worker use during work hours. In general, workers may not use corridors, stairs or elevators designated for student or school staff.
  2. Large amounts of debris must be removed by using enclosed chutes or a similar sealed system. There shall be no movement of debris through halls of occupied spaces of the building. No material shall be dropped or thrown outside the walls of the building.
  3. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times that classes are in session.
- B. Architect to provide exiting plans to contractor prior to construction.

## 1.5 EXITING AND VENTILATION

- A. General trades contractors shall maintain exiting and HVAC contractor shall maintain ventilation during school construction projects.
1. General trades contractors shall provide a plan detailing how codes required for exiting are maintained during construction. The plan shall indicate how temporary construction is required to isolate construction equipment, materials, people, dust, fumes, odors and noise during the construction period. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure. At minimum, required exits, temporary stairs, ramps exit signs and door hardware shall be provided at all times. These requirements are to follow the provided phasing plan.
  2. The HVAC contractor shall maintain proper ventilation during construction, including ventilation to occupied spaces with ductwork linked to construction areas. This includes ductwork which must be re-routed, disconnected, or capped in order to prevent contaminants from the construction area from entering the occupied areas of the building. Required ventilation to occupied spaces affected by construction shall be maintained during the project.

## 1.6 FIRE AND HAZARD PREVENTION

- A. Areas of building under construction that are to remain occupied shall maintain a certificate of occupancy. In addition, the following shall be strictly enforced:
1. No smoking is allowed on public school property, including construction areas.
  2. During construction, daily inspections of district occupied areas shall be conducted by school district personnel to assure that construction materials, equipment or debris do not block fire exits or emergency escape windows. All contractors are responsible to keep all exits free of obstructions.
  3. General trades contractors shall maintain proper operation of fire extinguishers, fire alarms and smoke/fire detection systems throughout the project.

## 1.7 CONSTRUCTION NOISE

- A. All contractors to comply with noise abatement during construction and maintenance activities. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces or shall be scheduled for times when the building or affected building spaces are not occupied or acoustical abatement measures shall be taken. Noise level measurements (dba) shall be taken with a type 2 sound level meter in the occupied space in a location closest to the source of the noise. Complaints regarding excessive noise shall be addressed through the health and safety committee. The owner shall enforce “No Work” periods if unacceptable noise levels are reported.

## 1.8 CONSTRUCTION FUME CONTROL AND OFF GASING

- A. All contractors shall provide control of chemical fumes, gases, and other contaminants during construction and maintenance projects. Contractors shall perform work that includes welding, gasoline engines, roofing, paving, painting or other activities that will produce fumes, during times the building is unoccupied and fumes must be exhausted. Care must be taken to assure fresh air intakes do not draw in such fumes.
  - 1. Contractors shall provide required schedules, which have to be approved by the owner, of work on construction and maintenance projects which includes time for “off-gassing” of volatile organic compounds introduced during construction before occupancy is allowed. Specific attention is warranted for activities including glues, furniture, paint, carpeting, wall coverings, and drapery. Contractors shall provide submittals with scheduled information regarding appropriate temperatures and times needed to cure or ventilate the product during use and before safe occupancy of a space can be assured. Building materials or furnishings which “off-gas” chemical fumes, gases, or other contaminants shall be aired out in a well ventilated heated warehouse before it is brought to the project for installation or the manufacturers recommended “off-gassing” periods must be scheduled between installation and the use of space. If the work will generate toxic gases that cannot be contained in the isolated area, the work must be done when school classes and programs are not in session. The building must be properly ventilated, and the material must be given proper time to cure or “off-gas” before re-occupancy.
  - 2. Contractors shall provide manufacturer’s Material Safety Data Sheets (MSDS) that shall be maintained at the site for all products used in the project. MSDS must be provided to anyone who requests them, including the owner. MSDS are to indicate chemicals used in the product, product toxicity, typical side effects of exposure to the product and safe procedures for use of the product.

## 1.9 ASBESTOS ABATEMENT

- A. All asbestos abatement projects shall comply with all applicable Federal and State laws including but not limited to the New York State Department of Labor industrial code rule 56 (12 NYCRR 56), and the Federal Asbestos Hazard Emergency Response Act (AHERA), 40 CFR part 763 (Code of Federal Regulations, 1998 Edition, Superintendent of Public Documents, U.S.

Government Printing Office, Washington DC 20402; 1998; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234). Large and small asbestos projects involving the removal, disturbance, repair, encapsulation, enclosure, or handling of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material may be performed in unoccupied areas of an occupied building in accordance with the above referenced regulations.

- B. All school areas to be disturbed during renovation or demolition have been or will be tested for asbestos. The project folder should contain a letter regarding the presence of asbestos.
- C. It is our interpretation that the term “building”, as referenced in this section, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier.
- D. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

#### 1.10 LEAD ABATEMENT

- A. Lead Paint: Testing for the presence of lead has been contracted by the owner. A report outlining locations where lead is to be removed will be made available to contractors by the owner upon request prior to construction. Lead based paint will require abatement of those areas pursuant to protocols detailed in the “guidelines for the evaluation and control of lead based paint hazards in housing” (June 1995; U.S. Department of Housing and Urban Development, Washington DC, 20410) and in accordance with OSHA regulations 29CFR 1926.62.
- B. All school areas to be disturbed during renovation or demolition have been or will be tested for lead. The project folder should contain a letter regarding the presence of lead.
- C. Surfaces that will be disturbed during reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor of Supervisor which details provisions for occupant protections, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

END OF SECTION 014500

## SECTION 01 5000 – TEMPORARY FACILITIES AND CONTROLS

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, security and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Electric
  - 2. Gas
  - 3. Water
  - 4. Waste Piping
  - 5. Toilets
  - 6. Telephones
  - 7. Temporary Electric Service
  - 8. Temporary Heating and Ventilation, Indoor Air Quality Measures
  - 9. Fire Protection
  - 10. Temporary Site Entrance and Staging Areas
  - 11. Cleaning Operations
- C. Support facilities include, but are not limited to, the following:
  - 1. Field Offices and Storage Sheds.
  - 2. Temporary enclosures.
  - 3. Temporary project identification signs and bulletin boards.
  - 4. Waste disposal services.
  - 5. Rodent and pest control.
  - 6. Construction aids, miscellaneous services and facilities.
  - 7. Temporary Site Entrance, Parking, and Staging Areas.
  - 8. Concrete Washout Stations
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, and lights.
  - 3. Environmental protection.

#### **1.3 DIVISION OF RESPONSIBILITIES**

- A. **General:** These Specifications assign each Prime Contractor specific responsibilities for certain temporary facilities used by other Prime Contractors and other entities at the site.

- B. Each Prime Contractor is responsible for the following:
1. Installation, operation, maintenance and removal of each temporary facility considered as its own normal construction activity, as well as the costs and use charges associated with each facility.
  2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
  3. Its own storage and fabrication sheds.
  4. Hoisting requirements, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside the building enclosure.
  5. Collection and disposal of its own hazardous, dangerous, unsanitary, or other harmful waste material.
  6. Secure lockup of its own tools, materials, and equipment
  7. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
  8. Clean up to dumpsters and legal disposal of all debris.
  9. Firearms, tobacco products, e-cigarettes, pornography, drugs, and alcohol are strictly forbidden. Anyone caught in possession of any of these items is subject to immediate and permanent dismissal from the project.
  10. Smoking ban on Lake Shore Central School District property – Contractor's employees are strictly forbidden to use any tobacco products on site.

#### 1.4 USE CHARGE

- A. **General:** Unless noted otherwise, cost or use charges for temporary facilities are not chargeable to the Owner or the Architect or the Construction Manager. The Architect or Construction Manager will not accept a Prime Contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.
- B. **Water Service:** Use water from the Owner's existing water system without metering and without payment of use charges. The Owner shall designate access to water.
- C. **Electric Power Service:** N/A
- D. **Sewer Service Use Charge:** N/A
- E. Other entities using temporary services and facilities include, but are not limited to, the following:
1. The Construction Manager.
  2. Other non-prime Contractors.
  3. The Owner's work forces.
  4. Occupants of the Project.
  5. The Architect, Engineers, or other Design Consultants.
  6. Testing or inspection agencies.
  7. Personnel of government agencies.
  8. Other Prime Contractors.
  9. The School District and authorized personnel.

## 1.5 SUBMITTALS

- A. **Temporary Facilities:** Each Prime Contractor shall submit a plan for the implementation of all temporary facilities and utilities for the project.
- B. Each Prime Contractor shall immediately apply to local, town, or the utility company, for necessary permits and services and pay all fees as may be required.
- C. Each Prime Contractor shall submit a detailed plan for temporary facilities to the Construction Manager, Architect, and Owner.
- D. Each Prime Contractor shall submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities to the Construction Manager.
- E. **Implementation and Termination Schedule:** Within fifteen (15) days of the date established for submittal of the Contractor's Construction Schedule, each Prime Contractor shall submit a schedule indicating implementation and termination of each temporary utility for which the Contractor is responsible.

## 1.6 QUALITY ASSURANCE

- A. **Regulation:** Each Prime Contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 1. Building code requirements.
  - 2. State Education Department.
  - 3. Health and safety regulations.
  - 4. Utility company regulations.
  - 5. Police, fire department and rescue squad rules.
  - 6. Environmental protection regulations.
  - 7. Department of Labor Laws
- B. **Standards:** Each Prime Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions but merely to assign responsibility to a Prime Contractor.
  - 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. **Inspections:** Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits and pay all associated fees. Submit a copy of all certification and permits to the Construction Manager.



D. **Uniform Safety Standards for School Construction and Maintenance projects:** (refer to Section 01 5000 for designation of specific responsibilities associated with the following standards):

1. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.
2. Provide documentation that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and asbestos.
3. The following are general safety and security standards for construction projects:
  - a. All construction materials shall be stored in a safe and secure manner.
  - b. Fences around construction supplies or debris shall be maintained.
  - c. Gates shall always be locked unless a worker is in attendance to prevent unauthorized entry.
  - d. During exterior renovation work, overhead protection shall be provided for any sidewalks or areas immediately beneath the work site or such areas shall be fenced off and provided with warning signs to prevent entry.
  - e. Workers shall be required to wear photo identification badges at all times for identification and security purposes while working at occupied sites.
4. Separation of construction areas from occupied spaces. Construction areas under the control of a contractor and therefore not occupied by District staff or students shall be separated from occupied areas. Provisions shall be made to prevent the passage of dust and contaminants into occupied parts of the building. Periodic inspection and repairs of the containment barriers must be made to prevent exposure to dust or contaminants. Gypsum board must be used in exit ways or other areas that require fire rated separation. Heavy-duty plastic sheeting may be used only for a vapor, fine dust or infiltration barrier, and shall not be used to separate occupied spaces from construction areas.
  - a. In general, workers may not use corridors, stairs or elevators designated for students or school staff. Reference the Site Safety and Logistics Plan for access during construction.
  - b. There shall be no movement of debris through halls of occupied spaces of the building during school hours. No material shall be dropped or thrown outside the walls of the building.
  - c. All occupied parts of the building affected by renovation activity shall be cleaned at the close of each workday. School buildings occupied during a construction project shall maintain required health, safety and educational capabilities at all times when classes are in session.
5. Construction and maintenance operations shall not produce noise in excess of 60 dba in occupied spaces. Otherwise, Work shall be scheduled for times when the building or affected building spaces are not occupied, or acoustical abatement measures shall be taken.
6. Each Prime Contractor shall be responsible for the control of chemical fumes, gases, and other contaminants produced by welding, gasoline or diesel engines, roofing, paving, painting, etc., to ensure they do not enter occupied portions of the building or air intakes. **All diesel engines shall be equipped with catalytic converters to minimize smoke and fumes.**

7. Each Prime Contractor shall be responsible for ensuring that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufactures recommendations before a space can be occupied.
8. Large and small asbestos projects as defined by 12NYCRR56 shall not be performed while the building is occupied. It is New York State interpretation that the term "building" as referenced in this section means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion and ventilation systems must be physically separated and sealed at the isolation barrier. If so isolated and unoccupied, the abatement project may proceed in the building.
9. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and at windows is provided. **Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.**
10. Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD guidelines and EPA and OSHA regulations.

## 1.7 PROJECT CONDITIONS

- A. **Temporary Utilities:** Each Prime Contractor shall prepare a schedule indicating dates for implementation and termination of each temporary utility for which the Contractor is responsible. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. **Conditions of Use:** Each Prime Contractor shall keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- C. **Temporary Use of Permanent Facilities:** The District reserves the right, in the best interest of the project, to utilize permanent building components as temporary methods to continue the construction process. Not unlike other components of the project, upon installation, the permanent components become the property of the District and shall not be controlled by any one Contractor. The Installer of each permanent service shall assume responsibility for its operation, maintenance, and protection during use as a construction facility prior to the Owner's acceptance, regardless of previously assigned responsibilities, without voiding any warranty / guarantee.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. **General:** Each Prime Contractor shall provide new materials. If acceptable to the Architect, undamaged, previously used materials in serviceable condition may be used. Provide materials suitable for use intended.
- B. **Lumber and Plywood:** Comply with requirements in Division 6 Section 06 1000 Rough Carpentry.
  - 1. For job-built temporary offices, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
  - 2. For signs and directory boards, provide exterior-type, Grade B-B density concrete form overlay plywood of sizes and thickness indicated.
  - 3. For fences and vision barriers, provide minimum 3/8-inch- (9.5-mm-) thick exterior plywood.
  - 4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch (16-mm-) thick exterior plywood.
- C. **Gypsum Wallboard:** Provide gypsum wallboard and metal stud on temporary interior walls as further clarified in Section 3.3 – Support Facilities Installation below.
- D. **Roofing Materials:** Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary offices, shops, and sheds.
- E. **Paint:** Comply with requirements of Division 9.
  - 1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
  - 2. For sign panels and applied graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
  - 3. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.
- F. **Tarpaulins:** Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- H. **Construction Fencing:** 0.12-inch- (3-mm-) thick, galvanized 2-inch (50- mm) chain link fabric fencing 6 feet (2 m) with top & bottom tension wire and galvanized steel pipe posts, 1-1/2 includes (38 mm) I.D for line posts and 2-1/2 includes (64 mm) I.D. for corner posts. Provide two (2) 20-foot lockable gates with welded hinges to gate post and latches welded to its mounting post, sizes as to be determined by Construction Manager.
- I. **Safety Fencing:** The Site Work Contractor (Contract #201) shall provide orange plastic safety fencing with a 10-gauge wire between posts to prevent any sagging around open pits and excavations to protect the general public for their scope of work.

## **2.2 EQUIPMENT**

- A. **General:** Each Prime Contractor shall provide new equipment. If acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended, where and if required.
- B. **Water Hoses:** Provide 3/4-inch (19-mm) heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. **Electrical Outlets:** Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. **Electrical Power Cords:** Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- E. **Lamps and Light Fixtures:** Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures, where exposed to breakage. Provide exterior fixtures, where exposed to moisture.
- F. **Heating Units:** Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. **Fire Extinguishers:** Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate as directed by the Construction Manager. Modify facilities as required at no additional cost to the owner.
- B. Each Prime Contractor shall provide each facility ready for use when needed to avoid delay to the Project. Maintain, modify and relocate as required at no addition cost. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 **TEMPORARY UTILITY INSTALLATION**

- A. **General:** Engage the appropriate local utility company to install temporary service or connect to existing service if necessary and applicable. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
1. Arrange with the company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
  2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
- B. **Temporary Electric:**
1. Each Contractor shall provide their own extension lines, and other equipment. Welding equipment shall run from generator trucks.
  2. Each contractor shall provide temporary connections between all power, heating equipment, life safety, and communication systems as necessary to maintain District occupancy. Provide for continuous operation of the building fire alarm system(s), whether temporary or permanent.
  3. The Electrical Contractor (Contract #305) shall provide 500 lf. of additional temporary lighting to be installed in temporary corridors or adjacent to the temporary partitions. Coordinate with General Trades Contractor (Contract #302).
- C. **Temporary Water Service**
1. Each Prime Contract shall provide and maintain temporary water service for the work of their contract, including water distribution piping and hose bibs on sites, as required throughout the construction period. Each Prime Contractor shall provide temporary water services to all buildings as required to complete their work during all shut downs necessary for utility changeovers.
  2. Users shall provide their own hoses from hose bibs to points of need but shall practice prudent conservation.
  3. Site dust control and erosion control is the responsibility of the Site Work Contractor (Contract #301) throughout construction for all site areas, including the supply of water used for dust control for their individual scopes of work. The General Trades Contract (Contract #302) is responsible for dust control within the limits of the building, including supply of water used for dust control.
- D. **Temporary Sanitary Facilities**
1. The Site Work Contractor (Contract #301) shall provide temporary portable chemical toilet facilities for use of all the **Eagle Drive Sitework** construction personnel, to meet O.S.H.A. standards, and shall maintain, service and clean these facilities for the duration of the project.

2. The General Trades Contractor (Contract #302) shall provide **where work occurs OF ALL PRIME CONTRACTORS, except for the sitework**, temporary portable chemical toilet facilities for use of all Prime Contractor's construction personnel, to meet O.S.H.A. standards, and shall maintain, service and clean these facilities for the duration of the project.
3. Provide at least one unit for each twelve (12) personnel on site.
4. Provide separate, well-identified, locked facilities for female personnel. Provide keys for the locking toilet to the Construction Manager for distribution.
5. Location of units to be field coordinated with the Construction Manager.
6. Provide and maintain all units in a clean and sanitary condition. At the minimum, clean on a weekly basis, and more often as necessary. Provide all toilet supplies as required including toilet paper, soap, paper towels, and waste receptors.
7. Provide hand wash stations with soap and hand sanitizer (70% alcohol content) for use by Contractors adjacent to the sanitary facilities. During below freezing weather, this will be located inside a heated construction area nearest and convenient to the sanitary facilities.

**E. Temporary Heating/Ventilation**

1. Not Required

**F. Temporary Construction Manager/Architect/Owner Field Office Service:**

The General Trades Contractor (Contract #302) shall provide the following:

1. Provide the following new office furniture, equipment and office supplies which will become the property of the District upon completion of the project:
  - a. \$500 Allowance for additional office supplies.
2. The General Trades Contractor (Contract #302) shall provide Bottled Water Service (Hot & Cold): **From Fall 2027 through Substantial Completion of Project.**

**G. Temporary Fire Protection**

1. Each Prime Contractor shall furnish temporary fire protection in the course of performing their work.

**H. Temporary Construction**

1. Temporary bridging, decks, hoists, lifts, scaffolding, and cranes shall be the responsibility of Contractor requiring it.
2. First aid requirements are the responsibility of each Contractor.

3. Temporary partitions and barricades are the responsibility of General Trades Contractor (Contract #302). Construction shall be in accordance with NYSED Uniform Safety Standards for School Construction.
  - a. The General Trades Contractor (Contract #302) shall be responsible for the full height temporary partitions at restrooms A103 & A104, 174 & 175, and 250A & 250B. The walls shall be 2'x4' wood studs and (1) layer of drywall. Each location shall have (1) temporary 36" door frame and door to provide access to the space during the school year.
  - b. The General Trades Contractor (Contract #302) shall be responsible for the full height 3-5/8" metal stud wall with insulation and drywall on both sides for sound attenuation. A temporary door is not required for this location.
4. The Site Work Contractor (Contract #301) and General Trades Contractor (Contract #302) are responsible for preparing the site as shown on the Site Safety & Logistics Plans at each building site. This includes installation of, maintenance of, and removal/restoration of all fencing, staging areas, temporary office location, temporary walkways, roadways, roadway barriers, pavement markings, etc. for the work of their contract at the of the project.
  - a. The Site Work Contractor (Contract #301) is responsible for temporary fencing, etc. associated with Eagle Drive Expansion as directed by the Owner and/or Construction Manager. The General Trades Contractor (Contract #302) is responsible for the temporary fencing, etc. associated with the High School Main Entrance and District Office Storefront renovation as directed by the Owner and/or Construction Manager.

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities in designated area only.
  1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the District.
  2. Security is the responsibility of each Contractor.
- B. Provide non-combustible construction for offices, shops, and sheds located within the construction area as directed. Comply with requirements of NFPA 241.
- C. **Field Offices:** Each Prime Contractor may utilize one insulated, weather tight temporary office of sufficient size to accommodate personnel at the Project Site. Keep the office clean and orderly for use for small meetings. Location as approved by Construction Manager. Parking is restricted to foremen and/or superintendents only; employee parking at designated areas. Optionally furnish and equip office as necessary.

**Field Office location options:** Contractors can place a field office in the existing High School Staging area where there are provisions for power. The Site Contractor (Contract #201) has the ability to have a job trailer at the athletic fields. If power is desired for the High School staging area, the contractor will need to make direct arrangements with the Electrical Contractor w/o compensation from the project or owner.

**D. Temporary Access Roads and Staging Area:**

1. Storage of construction trailers and storage shed will be restricted to locations indicated on the Site Safety and Logistics Plan and as directed by the Construction Manager and may in no way interfere with the District's daily functions.
2. Temporary parking by construction personnel shall be allowed only in areas so designated on the Site Safety and Logistics Plan or as directed by the Owner and Construction Manager. The Owner does not want construction parking in existing parking lots, staff parking, student parking or driveways in front of the building and will subsequently have vehicles in violation of parking prohibitions towed from the site and all fees back charged to the responsible Contractor.
3. Traffic Regulations:
  - a. Access through Owner's entrances shall be limited.
  - b. Utilize only designated entrances.
  - c. Maintain all District traffic regulations.
4. Existing Staging Area, including but not limited to temporary parking, equipment and material storage shall be maintained by the General Trades Contractor (Contract #302). The General Trades Contractor (Contract #302) shall be responsible for weed whacking and mowing the staging area as necessary.
5. Construction parking will be allowed in areas depicted on the Site Safety and Logistics Plan.
6. Snow and ice removal at the Staging Areas shall be responsibility of the General Trades Contractor (Contract #302).

**E. Dewatering Facilities and Drains:** For temporary drainage, dewatering facilities and operations directly associated with construction activities of the project, the Contractor requiring same shall be responsible for providing.

**F. Temporary Enclosures:** Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. (9.2 s.m.) in area, use UL labeled fire-retardant-treated material for framing and main sheathing.



5. The Mechanical Contractor (Contract #304) shall enclose roof openings with blocking, plywood and EPDM until roof top appurtenances are placed. Removal of these roof opening enclosures and disposal to Dumpster shall be by the Mechanical Contractor (Contract #304).
- G. **Temporary Lifts and Hoists:** Each Prime Contractor shall provide facilities for hoisting materials, equipment and employees in the advancement of the Project. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. **Temporary Shoring:** Each Prime Contractor shall provide all shoring necessary for the advancement of the project and for the Work of their Contract. The work shall comply with all safety laws and be constructed so as not to interfere with other work. Coordinate with all other Contractors. Provide shoring plans to the Construction Manager prior to work. Temporary shoring must be delegated, designed, and P.E. stamped by a licensed Engineer in New York State.
- I. **Project Identification and Temporary Signs:** Prepare project identification and other signs of the size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit the installation of unauthorized signs. Contractor company signs are forbidden. See attachment at the end of spec section 01 5000.
  1. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors; provide a (4) foot by four (4) foot on pressure treated "A" face plywood, back painted, verbiage by Construction Manager/Architect. The General Trades Contract (Contract #302) shall provide the temporary signs.
  2. The General Trades Contract (Contract #302) shall provide twenty (20) construction signs in addition to what is shown on the drawings at locations to be specified by the Construction Manager. Signs required at all project sites as follows:
    - a. For construction traffic control/flow at entrances and exits. Location for signage of entrances and exits may be moved as work progresses during the project.
    - b. To direct visitors.
    - c. For construction parking.
    - d. To direct deliveries.
    - e. Warning signs as required.
    - f. Per OSHA standards as necessary.
    - g. Trailer identification.
    - h. For "No Smoking" safe work site at multiple locations.

- J. **Collection and Disposal of Waste:** Prime Contractors shall collect waste from construction areas and elsewhere, and load to dumpsters daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 3 days during normal weather or 1 day when the temperature is expected to rise above 80 deg. F (27 deg. C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully. The cost of all dumpster service for the duration of the project shall be as follows:

- The Site Work Contractor (Contract #301) shall provide dumpster service for the Work of their own Contract.
- The General Trades Contractor (Contract #302) shall provide dumpster service for the Work of their own Contract and for the Plumbing Contractor (Contract #303), Mechanical Contractor (Contract #304) and the Electrical Contractor (Contract #305) **interior building** scopes of work.

K. **General and Final Cleaning:**

1. The maintenance of a clean work site shall be the responsibility of each Contractor.
2. Each Contractor shall remove their own debris daily from work area to waste disposal containers (Dumpsters). Time lapse is not acceptable.
3. Each Contractor shall leave an area in the same condition in which it was found.
2. At each and every Contractor (excluding the Site Work Contractor) working on site shall contribute manpower every Friday at 8 A.M. to work as a team to remove debris to Dumpsters, manpower to be coordinated by Construction Manager. Manpower shall be present until Construction Manager is satisfied with jobsite appearance. Cleanup work shall continue until complete. At the discretion of the Construction Manager, a contractor not complying may be back charged for work performed by others. The responsibility of broom cleaning twice weekly remains with the General Trades Contractor (Contract #302) and shall include use of sweeping compound. The General Trades Contractor (Contract #302) will provide sufficient labor to once per week clean up all debris outside of all buildings including debris not generated by this contract. The General Trades Contractor (Contract #302) will remove all debris discarded but not removed by others to accomplish a thorough sweeping including moving aside boxes, equipment, materials etc... to provide a complete sweeping service. Debris, garbage, beverage, food containers left by others will be removed by the General Trades Contractor (Contract #302) to a dumpster during course of sweeping.
5. Dumpsters shall be located and accessible to building and roads. Each Contractor (excluding the Site Work Contractor) may load legally acceptable construction debris to the Dumpster.
6. Cost of all disposal fees shall be under the specific contractor providing the dumpster and shall remain on the project until project completion, or as directed by Construction Manager. The Contractor providing the dumpster shall secure Dumpsters during off-hours.
7. Each Prime Contractor shall be responsible for final cleaning of their work.

8. The General Trades Contractor (Contract #302) shall employ services of a Professional Cleaning Company for final cleaning of the Administration Suite before acceptance by the Owner.
9. Each Prime Contractor is specifically responsible for the following final cleaning before substantial completion and acceptance by the Owner:
  - a. Sitework Contract – (Contract #301); all sidewalks, roads, parking areas, plant bed and site.
  - b. General Trades Contract – (Contract #302); all structures, all finished surfaces including floors, casework, ceilings, interior and exterior walls, chalk and tack boards, cabinets, countertops, millwork.
  - c. Plumbing Contractor - (Contract #303); all equipment, pumps, valves, piping, storage tanks, gauges, meters, insulation, equipment specialties, etc.
  - d. Mechanical Contractor – (Contract #304); (HVAC), all equipment, piping, insulation, valves, pumps, boilers, breaching, AHU's, RTU's, ductwork, unit ventilators, grilles and diffusers, etc. Temperature controls, all equipment, piping conduits, devices, controllers, and all system components
  - e. Electrical Contractor – (Contract #305); all equipment, piping, conduits, raceways, cable trays, devices, cabinets, panels, switches, controllers, motors, fixtures, all system components, cover plates, shades, and diffusers, etc.
- L. **Protection of Work:** Each Prime Contractor is reminded to temporarily protect work in place, or work area, at all times, pre, during or post construction, until accepted by the Owner per article 10 of the General Conditions of the Contract.
  1. After building enclosure, either temporary or permanent, each Prime Contractor shall protect and maintain any and all their own specific work in place, or work responsibilities, from rain, water, snow, mud, dust, dirt, ice, freezing temperature, debris, etc.
  2. Each Prime Contractor is responsible for protection of work in place from the operations of other contractors. Communicate daily with other supervisory personnel. Coordinate with all trades.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Generally, each Prime Contractor is responsible for security and protection of their own work, work areas, temporary trailers or storage sheds, storage area, staging area, materials, or equipment stored on site, materials or equipment stored in the building, materials or equipment permanently installed in place, trucks, vehicles, or any item until legally becoming property of the District.
- B. **Temporary Facility Changeover:** Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion, per phased area, as requested by the Construction Manager.
- C. **Temporary Fire Protection:** Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against

reasonably predictable and controllable fire losses. Comply with NFPA 10, "Standard for Portable Fire Extinguishers," and NFPA 241, "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Each Contractor to furnish and locate fire extinguishers where convenient and effective for their intended purpose for the work of their contract.
  2. All contractors to store combustible materials in containers in fire-safe locations.
  3. All contractors to maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking.
  4. All contractors to provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- D. **Permanent Fire Protection:** At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facilities, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- E. **Barricades, Warning Signs and Lights:** Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- F. **Environmental Protection:** Each Prime Contractor shall provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that any other undesirable effect might result. Avoid using tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints and disruption.
- G. **Erosion and Sediment Control: At all other Sites:** The Site Work Contractor (Contract #301) shall comply with regulations of "New York Guidelines for Urban Erosion and Sediment Control" published by Soil and Water Conservation Society and appropriate local ordinances where applicable.
- 1) Erosion and Sediment Control Plan: Prepare "Erosion and Sediment Control Plan" for this Project in consultation with appropriate local agencies and soil conservation service.
    - a. Submit Erosion and Sediment Control Plan to appropriate local agency and obtain local agency acceptance prior to Preconstruction Conference or start of construction site.
    - b. At Preconstruction Conference, submit evidence of local agency acceptance of Erosion and Sediment Control Plan for Project, and schedule completion of construction required to install measures included in Erosion and Sediment Control Plan. **DO NOT BEGIN CONSTRUCTION AT SITE UNTIL SCHEDULE AND METHODS OF OPERATION INCLUDED IN EROSION AND SEDIMENT CONTROL PLAN HAVE BEEN ACCEPTED BY ARCHITECT.**
    - c. If Conditions change during construction, submit revised Erosion and Sediment Control Plan to Architect and other agencies as directed by Architect.

- 2) Erosion and Sediment Control Measures:

- a. Take precautions to prevent mud from construction site accumulating on adjoining public roads and sidewalks and Owner's roads and sidewalks. Clean accumulations of mud from public roads and sidewalks and from Owner's roads and sidewalks when required by public authorities and when directed by Architect.
  - b. Plan and execute construction by methods to control surface drainage from cuts and fills and from borrow areas, and to prevent erosion and sedimentations.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and erosion control devices or methods appropriate to conditions at site.
    3. Construct fills and waste areas by selective placement to avoid erosive surfaces silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- 3) Coordinate temporary erosion and sediment control measures with permanent erosion control features specified elsewhere in Contract Documents to maximum extent possible to assure economical, effective, and continuous erosion control.

### **3.5 OPERATION, TERMINATION, AND REMOVAL**

- A. **Supervision:** Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. **Maintenance:** Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations. Protection applies to each Prime Contractor until substantial completion is issued by the Architect.
- C. **Termination and Removal:** Unless the Construction Manager requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are the property of each Prime Contractor. The Owner reserves the right to take possession of project identification signs.
  3. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or

subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.

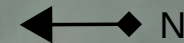
## Attachment #1 – Signage Schedule

Please contact Campus Construction Management Group, Inc., for a print-ready file. Signage files are scaled to 10%, please specify to printer that signs must be enlarged to 100% scale, 24"x36". Quantity of signs as per article I.2.

|                                                                                                                                                               |                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>CONSTRUCTION<br/>ENTRANCE</b></p>                                      | <p><b>ALL VISITORS<br/>MUST REPORT TO<br/>THE OFFICE OF THE<br/>CONSTRUCTION MANAGER</b></p>  |
| <p><b>CONSTRUCTION<br/>VEHICLE PARKING<br/>ONLY</b></p>                    | <p><b>CONSTRUCTION AREA<br/>AUTHORIZED PERSONNEL ONLY<br/>ALL WORKERS TO BE BADGED</b></p>  |
| <p><b>HARD HATS AND<br/>PROPER PPE SHALL BE<br/>WORN AT ALL TIMES</b></p>  | <p><b>NO<br/>SMOKING</b></p>                                                                |

END OF SECTION 01 5000





CAPITAL IMPROVEMENT  
PROJECT - PHASE 3

015000.1 - TEMPORARY  
FACILITIES AND CONTROLS

SITE SAFETY & LOGISTICS  
PLAN

LAKE SHORE  
SCHOOL DISTRICT  
HIGH SCHOOL

959 BEACH ROAD  
ANGOLA, NY 14006

GENERAL NOTES:

1. Reference 013200 - Construction Progress Documentation for schedule of temporary construction measures.
2. Reference 015000 - Temporary Facilities and Controls for contract-specific requirements.
3. Provide 1 man gate for every pair of swing gates. Location to be determined by Construction Manager.
4. All swing gates to be lockable and secured after each shift.

Contractor Staging Area

High School Front Entrance Renovation

District Office Storefront Replacement

High School Library Renovation Area

High School Pool Renovation Area

Phase 2 Contractor Work Area

Existing Phase 2 Site  
Access from Eagle Drive  
- TO BE MAINTAINED

EAGLE DRIVE

EAGLE DRIVE

Eagle Drive Replacement

ATHLETIC  
ENTERANCE

CCMG  
OFFICE  
Door 24

Contractor Parking

Erie 2-Chautauqua  
Cattaraugus BOCES...

Town of Evans Skatepark

William G. Houston  
Middle School

Beach Road

Beach Road

Route 5



## SECTION 016000 - PRODUCT REQUIREMENTS AND SUBSTITUTIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products and product substitutions.

#### 1.2 DEFINITIONS

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

#### 1.3 ACTION SUBMITTALS

- A. Substitution Procedures:
  - 1. All requirements documented below must be submitted in order for a substitution to be considered for review.
- B. Substitution Requests: Submit one copy of each request for consideration electronically by email only. Substitution request shall be addressed to the Architect with a copy to the Construction Manager. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Similar to CSI Form 13.1A as provided at the end of this section.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Detailed comparison of significant qualities of proposed substitution with those of the Work specified using a "point by point comparison" as provided at the end of this section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated. A product comparison form is included at the end of this section.
    - b. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - c. Samples, where applicable or requested.
    - d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    - e. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - f. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    - g. Contractor shall provide a detailed cost breakdown related to the suggested substitution. No add will be provided in the event of higher cost, however, a credit will be required to the owner in the event of a cost reduction due to acceptance of the substitution.
  3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Acceptance: Change Order.
    - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Timing: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
- D. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  2. Substitution request is fully documented and properly submitted.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given options of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

#### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
  1. Store products to allow for inspection and measurement of quantity or counting of units.
  2. Store materials in a manner that will not endanger Project structure.
  3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  6. Protect stored products from damage and liquids from freezing.
  7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

#### 1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 7700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Where products are accompanied by the term "as selected," Architect will make selection.
  - 3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  - 4. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
  - 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- B. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in this section for "Substitution Procedures" for proposal of product.
- C. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION

POINT BY POINT COMPARATIVE (REQUIRED FOR CSI FORM 13.1A)

PROJECT NAME:

YWA PROJECT #

SUBMITTAL #

DATE:

DESCRIPTION:

MANUFACTURER:

SUPPLIER:

CONTRACT:

SPEC SECTION:

SPECIFIED PRODUCT

PROPOSED SUBSTITUTION

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SUBSTITUTION REQUEST FORM (POST BID)

|                                  |                          |
|----------------------------------|--------------------------|
| PROJECT:                         | SUBSTITUTION REQUEST NO. |
| TO: YOUNG + WRIGHT ARCHITECTURAL | FROM:                    |
|                                  | DATE:                    |
| RE: SUBSTITUTION REQUEST FOR     | A/E PROJECT NO.          |
|                                  | CONTRACT FOR:            |

|                      |                          |
|----------------------|--------------------------|
| SPECIFICATION TITLE: | DESCRIPTION:             |
| SECTION:             | PAGE: ARTICLE/PARAGRAPH: |

|                              |
|------------------------------|
| <b>PROPOSED SUBSTITUTION</b> |
|------------------------------|

|                                                       |
|-------------------------------------------------------|
| <b>MANUFACTURER:</b>                                  |
| <b>TRADE NAME:</b>                                    |
| <b>ADDRESS:</b>                                       |
| <b>PHONE:</b>                                         |
| <b>MODEL NO.:</b>                                     |
| <b>INSTALLER:</b>                                     |
| <b>ADDRESS:</b>                                       |
| <b>PHONE:</b>                                         |
| <b>HISTORY: NEW, 2-5YRS OLD, 5-10YRS OLD, 10+ YRS</b> |

|                                                                         |
|-------------------------------------------------------------------------|
| <b>DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT:</b> |
|                                                                         |
|                                                                         |
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|                                                                         |

\_\_\_ POINT-BY-POINT COMPARATIVE DATA ATTACHED - REQUIRED BY A/E

|                                                 |
|-------------------------------------------------|
| <b>REASON FOR NOT PROVIDING SPECIFIED ITEM:</b> |
|                                                 |
|                                                 |
|                                                 |
|                                                 |
|                                                 |

**SIMILAR INSTALLATION:**

|                 |                        |
|-----------------|------------------------|
| <b>PROJECT:</b> | <b>ARCHITECT:</b>      |
| <b>ADDRESS:</b> | <b>OWNER:</b>          |
|                 | <b>DATE INSTALLED:</b> |

|                                                               |
|---------------------------------------------------------------|
| <b>PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK: Y/N</b> |
| <b>EXPLAIN:</b>                                               |

|                                                                                   |
|-----------------------------------------------------------------------------------|
| <b>SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION: \$</b>                            |
|                                                                                   |
| <b>PROPOSED SUBSTITUTION CHANGES CONTRACT TIME: Y/N [ADD]<br/>[DEDUCT]___Days</b> |
|                                                                                   |

|                                  |  |
|----------------------------------|--|
| <b>SUPPORTING DATA ATTACHED:</b> |  |
| <b>DRAWINGS</b>                  |  |
| <b>PRODUCT DATA</b>              |  |
| <b>SAMPLES</b>                   |  |
| <b>TESTS</b>                     |  |

|                |  |
|----------------|--|
| <b>REPORTS</b> |  |
| <b>OTHER</b>   |  |

**THE UNDERSIGNED CERTIFIES:**

Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.

Same warranty will be furnished for proposed substitution as for specified product.

Same maintenance service and source of replacement parts, as applicable, is available.

Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.

Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.

Proposed substitution does not affect dimensions and functional clearances.

Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

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| <b>SUBMITTED BY:</b> |
| <b>SIGNED BY:</b>    |
| <b>FIRM:</b>         |
| <b>ADDRESS:</b>      |
|                      |
| <b>TELEPHONE:</b>    |
| <b>ATTACHMENTS:</b>  |
|                      |
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| <b>A/E'S REVIEW AND ACTION</b> |
|--------------------------------|

     **SUBSTITUTION APPROVED - MAKE SUBMITTALS IN ACCORDANCE WITH SPEC. SECTION 01330.**

     **SUBSTITUTION APPROVED AS NOTED - MAKE SUBMITTALS IN ACCORDANCE WITH SPEC. SECTION 01330.**

     **SUBSTITUTION REJECTED - USE SPECIFIED MATERIALS.**

     **SUBSTITUTION REQUEST RECEIVED TOO LATE - USE SPECIFIED MATERIALS.**

|                             |
|-----------------------------|
| <b>CONTRACTOR COMMENTS:</b> |
|                             |
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| <b>SUBCONTRACTOR COMMENTS:</b> |
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|---------------------------|
| <b>SUPPLIER COMMENTS:</b> |
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| <b>MANUFACTURER COMMENTS:</b> |
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| <b>A/E COMMENTS:</b> |
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END OF SECTION 016000



## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.

#### 1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

#### 1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Mechanical systems piping and ducts.

- f. Control systems.
  - g. Communication systems.
  - h. Fire-detection and -alarm systems.
  - i. Conveying systems.
  - j. Electrical wiring systems.
  - k. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
- a. Water, moisture, or vapor barriers.
  - b. Membranes and flashings.
  - c. Exterior curtain-wall construction.
  - d. Sprayed fire-resistive material.
  - e. Equipment supports.
  - f. Piping, ductwork, vessels, and equipment.
  - g. Noise- and vibration-control elements and systems.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.
- F. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking, attachment plates, anchors, and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  2. Allow for building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
  2. **Each Prime Contractor shall be responsible for all cutting and patching required to complete work in their own contract unless stated differently in the Prime Contracts scope of work in Section 01 1000 Multiple Contract Summary**
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "Multiple Contract Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.



### 3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition and construction waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.

#### 1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Section 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area for Owner.
  - 4. Transport items to Owner's storage area designated by Owner.
  - 5. Protect items from damage during transport and storage.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Plumbing Fixtures: Separate by type and size.
- F. Lighting Fixtures: Separate lamps by type and protect from breakage.
- G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.

- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removal from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

### 3.5 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.

- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.

#### 1.2 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

#### 1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
  - 5. Submit test/adjust/balance records.
  - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 2900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On

receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the following format:
    - a. PDF electronic file. Architect will return annotated file.

## 1.6 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.



3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and anti-pollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

- g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 01 7419 "Construction Waste Management and Disposal."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

#### 1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and operation and maintenance manuals, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.

2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversized drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
  1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
  1. Startup procedures.
  2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.



## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Section 01 7839 "Project Record Documents."
- F. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.

#### 1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
    - a. Final Submittal:
      - 1) Submit One paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints.
      - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

### PART 2 - PRODUCTS

#### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Names of Architect and Construction Manager.

- e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file, one paper copy, or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file, one paper copy or scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean,

dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

#### 1.2 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

#### 1.3 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

### PART 2 - PRODUCTS

#### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Construction Manager, with at least 7 days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

### 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.



1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
  2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration while video recording is recorded. Include description of items being viewed.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

#### 1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### 1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.4 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect and Construction Manager of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
  - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
  - 1. Roof Warranties.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## 1.6 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
  - 1. Comply with requirements specified in Section 01 3233 "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
  - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
  - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
  - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly. Comply with requirements in Section 01 7419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings.
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 5323 "EPDM Roofing" for new roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 7419 "Construction Waste Management and Disposal."
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 028213 – ASBESTOS ABATEMENT

### PART 1 - GENERAL

#### 1.01 - SUMMARY:

- A. This project consists of the removal of asbestos materials as part of planned renovations associated with the Lake Shore Central School District 2023 Capital Improvement Project – Phase 3. Work areas are designated on the contract drawings.
- B. This section specifies the procedures for removal of existing asbestos containing/contaminated building materials, disposal of removed materials, and the encapsulation of building surfaces and/or components where asbestos containing materials have been removed AFTER FINAL CLEARANCE AIR MONITORING HAS BEEN SUCCESSFUL.
- C. Disturbance or dislocation of asbestos containing materials may cause asbestos fibers to be released into building's atmosphere, thereby creating a health hazard to work persons and building occupants. Consistent with asbestos control work, Contractor shall appraise all of his workers, supervisory personnel, subcontractors and consultants who will be at job site of the seriousness of the hazard and of proper work procedures which must be followed.
- D. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb or otherwise function in the immediate vicinity of any identified asbestos containing materials, appropriate, continuous measures as necessary to protect all building occupants from the hazard of exposure to airborne asbestos shall be taken. Such measures shall include the procedures and methods described herein, regulations of the U.S. Occupational Safety & Health Administration (OSHA), U.S. Environmental Protection Agency (EPA), and the New York State Department of Labor.
- E. Definitions: The following definitions apply throughout the Contract Documents:
  - 1) Aggressive Sampling: A method of sampling in which the person collecting the air sample creates activity by the use of mechanical equipment during the sampling period to stir up settled dust and simulate activity in that area of the building.
  - 2) AIHA: The American Industrial Hygiene Association 2700 Prosperity Ave., Suite 250 Fairfax, VA. 22031
  - 3) Airlock: A system for permitting entrance and exit while restricting air movement between a contaminated area and an uncontaminated area. It consists of two curtained doorways separated by a distance of at least of three feet, such that one passes through one door way into the air lock, allowing the doorway sheeting to overlap and close the opening before proceeding through the second doorway, thereby preventing flow-through contamination.
  - 4) Air Monitoring: Employment of sampling techniques and the process of measuring the fiber content of a specific volume of air in a stated period of



- time. Analysis of air samples shall be by Phase Contrast Microscopy in accordance with the OSHA reference method or Transmission Electron Microscopy in accordance with EPA methodology.
- 5) Amended Water: Water to which a surfactant has been added to a ratio according to the manufacturer's directions.
  - 6) Area Air Sampling: Any form of air sampling or monitoring where the sampling device is at some stationary location using non-aggressive techniques.
  - 7) Asbestos Contractor/Supervisor: A person who has attended the training course for contractor supervisor and has successfully passed the test under a program certified by the USEPA and as described within NYSDOL ICR #56.
  - 8) Asbestos Handler: An individual who installs, removes, applies, encapsulates, or encloses asbestos containing material, or who disturbs friable asbestos or asbestos containing material, and as defined within section 56-2.2 (C) of NYSDOL ICR # 56.
  - 9) Asbestos Handling Certificate: A certificate issued by the New York State Commissioner of Labor to a person who has satisfactorily completed an approved asbestos safety program.
  - 10) Asbestos Handling License: A license issued by the Commissioner of Labor pursuant to the provisions of Part 56, Title 12, NYCRR to a contractor engaged in the installation, removal, application, enclosure or encapsulation of asbestos or asbestos containing material or the disturbance of friable asbestos.
  - 11) Asbestos Project: Work undertaken by a licensed contractor which involves the installation, removal, encapsulation, application or enclosure of any asbestos or asbestos containing material, or the disturbance of friable asbestos. At the time that such disturbance occurs, the project shall become an asbestos project and all further work on that portion of the project, which resulted in such disturbance, shall be conducted in accordance with the requirements of this specification. Where all asbestos work on a project is subcontracted to a contractor with an Asbestos Handling License, only that part of work involving asbestos shall be deemed to be an asbestos project.
  - 12) Asbestos Removal/Abatement Operations: All herein specified procedures pertaining to the removal of asbestos containing materials and disposing of these materials at an EPA approved site.
  - 13) Authorized Visitor: The building owner, his or her agent or representative, any party contracting for services on an asbestos project whether on his or her own behalf or on the behalf of another, insurance appraisers or inspectors, utility company representatives, the Commissioner (NYSDOL) or his/her agents, and personnel of any regulatory or other agency having jurisdiction over the project.
  - 14) Clean Equipment Room: A room between the holding room and non-work area which is part of the equipment decontamination enclosure system. This room shall remain uncontaminated at all times.
  - 15) Clean Room: An uncontaminated room which is part of the work decontamination enclosures system, with provisions for storage of workers' street clothes and protective equipment.
  - 16) Critical Barrier: A unit of temporary construction which provides the only separation between an asbestos work area and an adjacent, potentially occupied space. The critical barrier will be comprised of a minimum of two independent and intact sheets of six mil polyethylene sheeting.
  - 17) Curtained Doorway: A device which consists of at least three overlapping sheets

- of plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top and left side, the second sheet at the top and right side, and the third sheet at the top and left side. All sheets shall have weights attached to the bottom to insure that the sheets hang straight and maintain a seal over the doorway when not in use.
- 18) Decontamination Enclosure System: A series of connected rooms separated from the work area and from each other by air locks, for the decontamination of persons, materials and equipment.
  - 19) Differential Air Pressure System: A portable, powered HEPA filtered system used to exhaust air from the work area to outside the building. A differential pressure condition must be maintained at any point in the work area no less than -0.02 inches water gauge relative to the pressure at any point outside the work area.
  - 20) Encapsulant: A liquid material which can be applied to asbestos containing material and which controls the possible release of asbestos fibers from the material by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant).
  - 21) Encapsulation: All herein specified procedures necessary to coat asbestos containing material or asbestos contaminated surfaces with an encapsulant to control the possible release of asbestos fibers into the ambient air.
  - 22) Equipment Decontamination Enclosure System: A decontamination system for materials and equipment consisting of a designated area of the work area for a washroom, holding room, and clean equipment room.
  - 23) Equipment Room: A room which is part of the worker decontamination enclosure system, with provisions for storage of potentially contaminated clothing or equipment. The equipment room shall be kept clean from suspect asbestos containing debris at all times.
  - 24) Final Clearance Level: Air samples for analysis using Transmission Electron Microscopy, which must average below 70 structures/mm<sup>2</sup>, will be collected under aggressive sampling conditions.
  - 25) Fixed Object: A unit of equipment or furniture in the work area which cannot be removed from the work area.
  - 26) HEPA Filter: A High Efficiency Particulate Air (HEPA) filter which has a tested and documented efficiency for trapping and retaining a minimum of 99.97% of a
  - 27) 0.3 micrometer (aerodynamic diameter) Dioctylphthalate (DOP) test aerosol.
  - 28) HEPA Vacuum Equipment: Vacuuming equipment with a HEPA filtration system capable of collecting and retaining asbestos fibers.
  - 29) Holding Room: A room between the washroom and clean equipment room in the equipment decontamination enclosure system. The holding room comprises an airlock, and must be maintained in an uncontaminated condition at all times.
  - 30) Movable Object: A unit of equipment or furniture in the work area which can be removed from the work area.
  - 31) Personal Air Monitoring: A method used to determine an individual's exposure to airborne fibers. The sample is collected outside the respirator in the person's breathing zone.
  - 32) Plasticize: To cover floors, walls, ceilings, and other surfaces with plastic sheeting as herein specified.
  - 33) Pre-cleaning: The process of cleaning (decontaminating) all objects, ceilings,

- walls, and floors of a proposed work area using wet cleaning methods, HEPA vacuuming equipment, etc. before abatement work area preparation activity commences.
- 34) Protection Factor: The ratio of the ambient airborne concentration of fibers to the airborne concentration of the fibers within the employee respirator face piece.
  - 35) Shower Room: A room between the clean room and the equipment room in the worker decontamination enclosure system equipped with a shower with hot and cold running water controllable at the tap. The shower shall be suitably arranged for complete showering during decontamination with a sufficient supply of soap at all times. The shower room comprises an airlock between the equipment and clean rooms.
  - 36) Static Air Sampling: Air monitoring without the use of fans or air circulating devices.
  - 37) Visible Emissions: Any emissions of particulate material that can be seen without the aid of instruments.
  - 38) Washroom: A room between the work area and holding area in the equipment decontamination enclosure system. The washroom comprises an airlock.
  - 39) Wet Cleaning: The process of eliminating asbestos and particulate contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with amended water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.
  - 40) Work Area: Designated area within a work site where an asbestos project occurs which either is contained or to which access is restricted under the NYSDOL ICR.

#### 1.02 - SCOPE OF WORK:

- A. All work under this contract shall be performed in strict conformance with applicable federal, state and local rules, laws and regulations.
- B. The specifications are to be used in conjunction with the contract drawings for this project. A copy of each shall be maintained at the job site at all times.
- C. Contractors shall verify all project conditions and material quantities prior to bidding the project.
- D. The Owner shall obtain the required Site-Specific Variance to complete the abatement work impacting asbestos-containing vapor barrier tar at the exterior walls. A copy of the approved variance file is appended to this Section
- E. The contractor shall furnish all labor, materials, services, employee training, permits, insurance and equipment to remove asbestos and building materials in locations indicated on the contract drawings.

#### 1.03 - QUALITY ASSURANCE:

- A. Contractor shall provide and assure that the quality of work practices and procedures are consistent with the below listed agencies. Contractor shall utilize the latest edition, including all addenda, revisions and supplements for all regulatory agencies codes, etc.,

including but not limited to:

- 1) Environmental Protection Agency (EPA).
- 2) Occupational Safety and Health Administration
- 3) State of New York codes and laws.
- 4) All local codes.

#### 1.04 - QUALIFICATIONS:

- A. The following qualifications must be met by all prospective bidders:
- B. Contractor Experience: Contractor shall have completed a minimum of three asbestos abatement projects of similar scope and nature, and hold a valid Asbestos Handling License issued by the Commissioner of the State of New York Department of Labor. Provide project names, locations and Owner Representative's Name and Phone Number. The contractor shall have held and currently hold a valid license for the past three consecutive years.
- C. Personnel: supervisors, foreman and workers shall have received training in applicable regulations and expertise in safety and environmental protection by participation and successful completion of a workers or contractors/supervisors training course offered by an EPA approved educational institution, and hold an Asbestos Handling Certificate issued by the New York State Department of Labor.
- D. Personnel Experience: all personnel including supervisors, foremen, and workers shall be experienced in asbestos abatement work as evidenced through participation in a minimum of three previous projects.

#### 1.05 - REGULATIONS:

- A. All work under this contract shall be performed in strict accordance with all applicable federal, state, and local regulations, standards, and codes governing asbestos abatement and any other trade work done in conjunction with the abatement including but not limited to those listed in Section 1.7 below.
- B. The most recent edition of any relevant regulation, standard, document, or code shall be applicable to the work. Where conflict among the requirements or with these specifications exists, the most stringent requirements are applicable.
- C. Copies of all relevant standards, regulations, codes, and other applicable documents and subsequent amendments thereto, listed in this section and including this Specification, shall be available at the work site in the clean change area of the worker decontamination system.

#### 1.06 - SPECIFIC REQUIREMENTS:

- A. Occupational Safety and Health Administration (OSHA)
  - 1) OSHA regulations governing asbestos abatement include, but are not limited to:
    - a) Title 29 CFR 1926.1101, occupational exposure to asbestos in construction.

- b) Title 29 CFR Section 1910.134, general industry standard for respiratory protection.
  - c) Title 29 CFR Section 1910.20, access to employee exposure and medical records.
  - d) Title 29 CFR Section 1910.1200, hazard communication.
  - e) Title 29 CFR Section 1910.145, specifications for accident prevention signs and tags.
  - f) Title 29 CFR Section 1910.95, noise regulation.
- B. Environmental Protection Agency (EPA)
  - 1) EPA regulations governing asbestos abatement include, but are not limited to:
    - a) Title 40 CFR Part 61, Subparts A and M, national emission standard for asbestos.
    - b) Title 40 CFR Part 763, asbestos - containing materials in schools, final rule and notice.
    - c) Title 40 CFR Part 763, Subpart G, regulations for asbestos abatement projects.
- C. New York State Requirements
  - 1) State regulations governing asbestos abatement include, but are not limited to:
    - a) New York State Department of Environmental Conservation (NYSDEC), Title 6 NYCRR, Part 360 and 364, the New York State hazardous waste management regulations.
    - b) Part 56 of Title 12 of the official compilation of codes, rules and regulations. aka "Code Rule 56".
    - c) Chapter II: Title 10, Part 73 of the New York Code of Rules and Regulations: Asbestos Safety Program Requirements.
    - d) Part 23 of Title 12 of the Official Compilation of Codes, Rules and Regulations.
- D. American National Standards Institute (ANSI)
  - 1) ANSI standards governing asbestos abatement include, but are not limited to:
    - a) Fundamentals governing the design and operation of local exhaust systems, Publication 29.2-79.
    - b) Practices for respiratory protection, Publication Z88.2-80.
- E. Compressed Gas Association (CGA)
  - 1) Pamphlet G-7, "Compressed Air for Human Respiration" and Specification G-7.1, "Commodity Specifications for Air."
- F. Mine Safety and Health Administration (MSHA)
  - 1) Certification of respirators as per 30 CFR Part 11.
- G. National Institute for Occupational Safety and Health (NIOSH)

- 1) NIOSH regulations governing asbestos abatement include, but are not limited to:
    - a) a guide to respiratory protection for the asbestos abatement industry.
    - b) approval of respirators as per 30 CFR PART 11.
    - c) standards for analysis of air samples.
- H. American Society for Testing and Materials (ASTM)
- 1) E 1368-05 Standard Practices for Visual Inspection of Asbestos Abatement Projects.
- I. Licenses
- 1) Contractor shall maintain current licenses as required by applicable state or local jurisdictions for the removal, transportation, disposal, or other regulated activity relative to the work of this Contract.
- J. New And Amended Regulations
- 1) Any and all new or amended federal, state, or local regulations becoming effective during this project and not listed are to be considered as part of this specification. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the Owner reserves the right to require the contractor to submit additional copies of these standards as necessary for enforcement of the requirements.
- K. Abbreviations And Names:
- 1) Where acronyms or abbreviations are used but not identified in specifications or other contract documents they are defined to mean the industry recognized name or trade association, standards generating organization, governing owner or other entity applicable to context of text provision. Refer to "Encyclopedia of Associations," published by Gale Research Co., available in large libraries. The following acronyms or abbreviations as referenced in Contract Documents are defined to mean the associated names. Both names and addresses are subject to change, and are believed to be, but are not assured to be, accurate and
  - 2) up-to-date as of date of Contract Documents:
- |      |                                                                                                    |
|------|----------------------------------------------------------------------------------------------------|
| AIA  | American Institute of Architects<br>1735 New York Ave., NW; Washington, D.C. 20006<br>202/626-7474 |
| ANSI | American National Standards Institute<br>1430 Broadway; New York, N.Y. 10018<br>212/354-3300       |

|        |                                                                                                                                                                                                                        |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASHRAE | American Society for Heating, Refrigerating, and Air Conditioning Engineers<br>1791 Tullie Circle NE; Atlanta, Ga. 30329<br>404/636-8400                                                                               |
| ASTM   | American Society for Testing and Materials<br>1916 Race St.; Philadelphia, Pa. 19103<br>215/299-5400                                                                                                                   |
| CFR    | Code of Federal Regulations - Available from Government Printing Office;<br>Washington, D.C. 20402<br>(usually first published in Federal Resister)                                                                    |
| CGA    | Compressed Gas Association<br>1235 Jefferson Davis HWY.; Arlington, Va. 22202<br>703/979-0900                                                                                                                          |
| CS     | Commercial Standard of NBS (U.S. Dept. of Commerce)<br>Government Printing Office<br>Washington, D.C. 20402                                                                                                            |
| EPA    | Environmental Protection Agency<br>401 M St., SW; Washington, D.C. 20460                                                                                                                                               |
| FS     | Federal Specification (General Services Admin.)<br>Obtain from your regional GSA Office, or purchase from GSA Specifications<br>Unit<br>(WFSIS); 7th and D Streets, SW, Washington, D.C. 20406<br>202/472-2205 OR 2140 |
| GA     | Gypsum Association<br>1603 Orrington Ave.; Evanston, IL 60201<br>312/491-1744                                                                                                                                          |
| GSA    | General Services Administration<br>F St. and 18th St., NW; Washington, D.C. 20405<br>202/655-4000                                                                                                                      |
| NBS    | National Bureau of Standards<br>(U.S. Dept. of Commerce)<br>Gaithersburg, MD. 20234<br>301/921-1000                                                                                                                    |
| NEC    | National Electrical Code (By NFPA)                                                                                                                                                                                     |
| NFPA   | National Fire Protection Association<br>Batterymarch Park; Quincy, Ma. 02269<br>617/770-3000                                                                                                                           |
| OSHA   | Occupational Safety & Health Administration<br>(U.S. Dept. of Labor)                                                                                                                                                   |
| PS     | Product Standard of NBS (U.S. Dept. of Commerce)<br>Government Printing Office;<br>Washington, D.C. 20402                                                                                                              |
| UL     | Underwriters Laboratories<br>333 Pfingsten Rd.; Northbrook, IL 60062<br>312/272-8800                                                                                                                                   |

#### 1.07 - NOTICES AND PERMITS:

##### A. Environmental Protection Agency:

- 1) At least ten (10) business days prior to beginning work on the asbestos containing materials, Contractor shall prepare and forward a NESHAPS Notification for Demolition and Renovation Activities to the EPA, National Emissions Standards for Hazardous Air Pollutants (NESHAPS) Coordinator, Air Facilities Branch, 26 Federal Plaza, New York, New York 10007; with a copy to the Owner.
- 2) The notification shall include the following information:
  - a) Facility Information :
  - b) Name and Address of Owner/Operator.
  - c) Name and Address of Abatement Contractor.
  - d) Address and description of the building, including its size and age; amount, in square feet or linear feet, of RACM, friable and non-friable asbestos material to be removed; and the nature of contract work.
  - e) Scheduled starting and completion dates for removal.
  - f) Procedures that will be employed to comply with appropriate EPA regulations to accomplish the work under this project.
  - g) Name and Address of Waste Transporter that will be used to haul/dispose of the removed asbestos waste.
  - h) Name and Address of waste disposal site where asbestos wastes will be deposited.

B. New York State Division of Safety and Health:

- 1) At least ten (10) calendar days prior to the start of work, the contractor shall submit written notice to New York State Asbestos Control Bureau, State Office Building Campus, Bldg. 12, Room 161B, Albany, N.Y. 12240, with a copy to the Owner.
- 2) The notification shall include the following information:
  - a) Type of Notification (Initial, Renewal, Amended etc.)
  - b) Name, address and Contractor's License Number of Abatement Contractor.
  - c) Address and description of the building, including its size, age and current use.
  - d) Amount, in square feet and/or linear feet, of friable and non friable asbestos material to be removed and the resultant filing fees.
  - e) The nature of contract work, Variances to be utilized, etc.
  - f) Scheduled starting and completion dates for removal and whether abatement will be phased.
  - g) Procedures that will be employed to comply with appropriate federal, state and local regulations to accomplish the work under this project.
  - h) Name and License No. of 3<sup>rd</sup> party Air Monitoring Firm
  - i) Name and ELAP Registration No. of Lab oratory performing the analysis of the project air samples.
  - j) Name and Address of Waste Transporter that will be used to haul/dispose of the removed asbestos waste.
  - k) Name and Address of waste disposal site where asbestos wastes will be deposited.

C. Building Owner and Occupants:

- 1) The contractor shall submit to the Owner for review, a draft copy of the written



notice to occupants fifteen days prior to the start of the abatement project. Written notices shall be posted at all entrances to the work area and on 1 floor above and below as required by New York State Department of Labor Code Rule 56, after the Owner's review and approval.

#### 1.08 - SUBMITTALS:

- A. The Contractor shall submit five (5) separately bound copies of all submittals for approval. A copy of all approved submittals is to be maintained at the work site.
- B. Two (2) copies of each submittal shall be returned to the Contractor with the following notation:
  - 1) Rejected - Revise and Resubmit:
    - a) The Contractor shall make the necessary corrections to the submittal or select alternate removal methods, materials, and/or equipment and resubmit five (5) complete copies.
  - 2) Approved as noted:
    - a) The Contractor may proceed with removal method, materials and/or equipment in accordance with the changes/requirements noted on the submittal. The Contractor shall resubmit two (2) copies of the submittal indicating compliance with notations prior to final payment.
  - 3) Approved:
    - a) The Contractor may proceed with the project and use of removal method, materials and/or equipment.
- C. The Contractor shall not proceed with removal method, materials and/or equipment prior to receipt of approval. Any removal method, material and/or equipment used which are not in compliance with "approved" or "approved as noted" shall be at no cost to the Owner.
- D. The Contractor shall submit to the Owner 15 working days before the start of work:
  - 1) Copies of the NYS Waste Transporter Permit (6 NYCRR part 364) for the entity or entities transporting waste from the Jobsite.
  - 2) Copies of the Contractor's New York State Asbestos Contractor's license.
  - 3) Work Plan – Contractor shall provide detailed abatement work plans for each work area including but not limited to decontamination enclosure location, regulated abatement work areas, and temporary enclosure measures.
- E. Following the completion of abatement activities, the Contractor shall submit the following Project Close-Out Documentation:
  - 1) Work area daily entry/exit logs.
  - 2) Contractor Supervisor's daily activity logs.
  - 3) List of Supervisor/Handler Personnel utilized on the Project and their Asbestos Handling Certificate Number
  - 4) Copies of Project NYSDOL and EPA NESHAP 10 Day Notifications
  - 5) All completed Non Friable Dump tickets/trucking/manifest forms which have been signed and certified by the Landfill's Owner/Manager as having

accepted the shipped waste must be returned directly to the Building Owner.

#### 1.09 - JOB CONDITIONS:

- A. Posting of regulations: Display the following documents in the clean changing area, in public view, for the full duration of the work:
- B. OSHA Regulation 1926.1101 Occupational Exposure to Asbestos.
- C. EPA 40 CFR, Part 61, Subpart B: National Emission Standard for asbestos, asbestos stripping work practices and disposal of asbestos waste.
- D. Industrial Code Rule 56 and any Variances to be used.
- E. Instructions for removing injured persons from work area.
- F. Post emergency action plan at the work site. This plan shall also include telephone numbers for hospital, doctor and Fire Company.
- G. Provide Sign In and Out sheets for all persons entering the work area.
- H. All notices and permits as required by NYSDOL ICR #56.

#### 1.10 - PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. The contractor shall be responsible for the delivery, storage and handling of all materials required to accomplish the work.
- B. The contractor shall deliver all materials in the original packages, containers, or bundles bearing the name of the manufacturer and the brand name.
- C. The contractor shall store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
- D. Damaged or deteriorated materials shall not be used and shall be removed from the premises at the contractor's expense. Materials that become contaminated with asbestos shall be disposed of in compliance with the provisions of this specification.

### PART 2 - PART 2 - PRODUCTS AND PROCEDURES

#### 2.01 - EMERGENCY PLANNING:

- A. Description
- B. The Contractor shall prepare an emergency preparedness plan detailing at least the information required in this section and in any applicable federal, state or local regulations.

C. Details of Plan

- 1) Emergency planning shall be developed prior to abatement initiation and submitted to the Owner for review under the requirements of section 1.9 of this specification.
- 2) Emergency procedures shall be in written form and prominently posted in the clean change area and equipment room of the worker decontamination area. Everyone, prior to entering the work area, must read and sign these procedures to acknowledge receipt review and understanding of work site layout, location of emergency exits, and emergency procedures.
- 3) Emergency planning shall include written notification of police, fire and emergency medical personnel of planned abatement activities, work schedule and layout of work area, particularly barriers that may affect response capabilities.
- 4) Emergency planning shall include considerations of fire, power failure, explosion, toxic atmospheres, electrical hazards, slips, trips, and falls, confined spaces, spills of releases of hazardous materials and heat related injury. Written procedures shall be developed and employee training in procedures shall be provided.
- 5) Employees shall be trained in evacuation procedures in the event of work place emergencies.
- 6) For Non life threatening Situations: Employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the work place to obtain proper medical treatment.
- 7) For Life threatening Injury or Illness: Worker decontamination shall take least priority. After measures to stabilize the injured worker, he/she shall be removed from the work place and secure proper medical treatment.
- 8) Telephone numbers of all emergency response personnel shall be prominently posted in the clean area and equipment room, along with the location of the nearest telephone.

2.02 - ABATEMENT PRODUCTS:

A. Polyethylene Sheeting

- 1) Polyethylene sheeting shall be a minimum of 6 mil in thickness, in widths selected to minimize joints.
- 2) Polyethylene sheeting utilized for worker decontamination enclosure shall be opaque white.
- 3) All polyethylene sheeting shall be fire retardant/rated.

B. Attachment Materials for Polyethylene: Method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and Owner and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of duct tape or other waterproof tape, furring strips, spray glue, staples, nails, screws, or other effective procedures capable of sealing adjacent sheets of polyethylene and capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions (including the use of amended water).

C. Disposal Bags: 6 mil polyethylene, pre-printed with labels as required by OSHA

Requirement 29 CFR 1926.1101(k)(8)(iii) or OSHA Requirement 29 CFR 1910.1001(j)(2), shall contain the following information:

DANGER CONTAINS ASBESTOS FIBERS  
MAY CAUSE CANCER  
CAUSES DAMAGE TO LUNGS  
DO NOT BREATHE DUST AVOID CREATING DUST

- D. Disposal Drums: metal or fiberboard with locking ring tops, with warning labels as required by OSHA or EPA.
- E. Stick-On Labels: consistent with OSHA Requirements (see 29 CFR 1926.1101 (K) (2) for disposal drums.
- F. Warning Signs: required by OSHA 29 CFR 1910.1001 (j) (1) or 29 CFR 1926.1101(k)(7)(ii)(A) and (B) and shall contain the following information:

DANGER ASBESTOS  
MAY CAUSE CANCER CAUSES DAMAGE TO LUNGS  
AUTHORIZED PERSONNEL ONLY

- G. Surfactant (Wetting Agent): 50/50 mixture of Polyoxyethylene Ether and Polyoxyethylene Ester, or equivalent, mixed in a proportion of 1 fluid ounce to 5 gallons of water or as specified by manufacturer. (An equivalent surfactant shall be understood to mean a material with a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM Method D1331-56 "Surface and Interfacial Tension of Solutions of Surface Active Agents"). Where work area temperature may cause freezing of the amended water solution, the addition of Ethylene Glycol in amounts sufficient to prevent freezing is permitted. Encapsulating Agent: provide a bridging type encapsulant specifically designed for application to ACM. Product shall be rated as acceptable for use intended when tested in accordance with draft ASTM proposed Standard E-6.21 Guide or evaluation of encapsulant for friable ACM building materials. All materials used shall have a flame spread of less than 25 when dry (when tested in accordance with ASTM-84).

#### 2.03 - GENERAL EQUIPMENT:

- A. A sufficient supply of disposable mops, rags, and sponges for work area decontamination shall be available.
- B. A sufficient supply of scaffolding, ladders, lifts, and hand tools, (e.g., scrapers, wire cutters, brushes, utility knives, wire saws, etc.) shall be provided as needed.
- C. Low pressure or airless sprayers.
- D. Rubber dustpans and rubber squeegees.
- E. Brushes utilized for removing loose asbestos containing material shall have nylon or fiber bristles, not metal.
- F. HEPA filtered vacuum cleaners.

- G. Water drain filters: AP-2000 by Creative Innovation or approved equal.
- H. Negative pressure machines: shall use centrifugal type fan: HEPA filters shall be closed on all edges with a ridge frame, filters shall be 99.97% effective down to 3 microns; two stage pre-filtration is required. Instrumentation shall include manometer, magnahelic gauge, and safety warning devices.

#### 2.04 - PERSONNEL PROTECTION:

- A. Full body disposable protective clothing, including head, body, and foot covering (unless using footwear as described below) consisting of material impenetrable by asbestos fibers (Tyvek or equivalent) shall be provided to all workers and authorized visitors in sizes adequate to accommodate movement without tearing. Provide a sufficient number for all required changes, for all workers and authorized visitors in the work area.
- B. Additional safety equipment (e.g., hard hats meeting the requirements of ANSI Standard Z89.1-1981, eye protection meeting the requirements of ANSI Standard Z87.1-1979, safety shoes meeting the requirements of ANSI Standard Z41.1- 1967, disposable PVC gloves or other work gloves), shall be provided to all workers and authorized visitors.
- C. Nonskid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.

#### 2.05 - TRAINING:

- A. All workers shall have current Asbestos Handling Certificates.
- B. Supervisory personnel shall be competent people, as defined in 29 CFR 1926.1101, and shall receive training as required in 29 CFR 1926.1101. Additionally, supervisors shall be a certified Contractor/Supervisor under NYSDOL ICR #56 requirements.

#### 2.06 - RESPIRATORY PROTECTION:

- A. All respiratory protection shall be provided to workers in accordance with the submitted written respiratory protection program, which includes all items in OSHA 29 CFR 1926.1101 and 1910.134 (B), (D), (E), and (F). This program shall be posted in the clean room of the worker decontamination enclosure system.
- B. Workers shall be provided with personally issued, individually identified (marked with waterproof designations) respirators.
- C. Respirators shall be selected that meet the following level of protection requirements: The workers will not be exposed to in excess of 0.1 f/cc, 8-Hour TWA.
- D. After the installation of the personal decontamination system, full personal protective equipment (PPE) in compliance with current OSHA regulations shall be worn in regulated abatement work areas during all area preparation and abatement activities for all OSHA Class I or Class II asbestos projects. In the absence of a valid Negative Exposure Assessment, the minimum level of acceptable Respiratory Protection shall be the PAPR for Class I work and a ½ Face NAPR for Class II Work. Asbestos Abatement Contractor's respirator selection, filter selection medical surveillance and respiratory

training shall be consistent with current OSHA Regulations. Appropriate respiratory protection is also required of authorized visitors in accordance with this Part.

E. Fit Testing

- 1) Workers must perform positive and negative air pressure fit tests each time a respirator is put on, whenever the respirator design so permits. Powered
- 2) air-purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- 3) Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA Regulation (29 CFR 1926.1101, Appendix C, Qualitative and Quantitative Fit Testing Procedures) for all respirators to be used on this abatement project. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.

F. No one wearing a beard or other facial hair which will reduce the performance of the respirator shall be permitted to don a respirator and enter the work area.

G. Respirator cartridges shall be replaced with new cartridges each time the worker exits the work area. Used cartridges shall be disposed of as asbestos contaminated waste. A sufficient supply of cartridges shall be maintained on site at all times.

2.07 - MEDICAL SURVEILLANCE:

- A. The Contractor must provide medical surveillance to any employee or agent that may be exposed to asbestos in excess of background levels during any phase of the abatement project. The surveillance and recordkeeping program shall be in accordance with 29 CFR 1926.1101 (M) and (N).
- B. Employees shall be given an opportunity to be evaluated by a physician to determine their capability to work safely while breathing through the added resistance of a respirator.

2.08 - VISITOR CLOTHING:

- A. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear as described herein, whenever they are required to enter the work area.

2.09 - PERSONAL AIR MONITORING:

- A. Contractor will be responsible for personal air monitoring of workers and short term excursion level testing. Certified copies of the laboratory results shall be provided to the Owner within 24 hours for evaluation and action if required.
- B. All personnel samples shall be collected and analyzed according to the OSHA recognized method by the contractor's certified and approved analytical firm. The contractor's laboratory shall be independent of the third party air monitoring firm retained by the Owner and must have the proper certifications and accreditation for

analysis by the selected methodology.

## PART 3 - PART 3 - EXECUTION

### 3.01 - GENERAL:

- A. Secure entire work area to prevent entry of unprotected/unauthorized persons.
- B. Cover, isolate, and seal work area walls and floors completely; including fixed equipment, doors, windows, skylights, lighting fixtures, duct openings, and all other openings into work area. Use polyethylene sheeting and seal edges with polyethylene adhesive tape.
- C. Build triple barriers of plastic sheeting at all entrances and exits to the work area so that the area is always closed off by one barrier when workers enter or exit.
- D. Establish emergency and fire exits from the work area as part of the written emergency action plan.
- E. Locate at the project site the log sheet sign in for all persons entering work area from the beginning to the completion of the final clearance of the abatement project.

### 3.02 - PREPARATION - WORK AREAS:

- A. The work areas shall be completely isolated from other parts of the building so as to prevent asbestos containing dust or debris from migrating beyond the isolated area. Should the area beyond the work area become contaminated with asbestos-containing dust or debris as a consequence of the work, the Contractor shall immediately notify the Owner and shall be responsible for cleaning, on a daily basis, those areas in accordance with the procedures indicated in paragraphs below. All costs incurred in cleaning, or otherwise decontaminating, non-work areas and the contents there of shall be borne by the Contractor including, but not limited to air monitoring, project monitoring, Owner labor, consulting service costs and fees. These areas shall be vacated and remain isolated until satisfactory clearance air monitoring results have been achieved.
- B. Signs: Caution signs shall be posted at all locations and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted that permit a person to read the sign and take the necessary protective measures to avoid exposure.
- C. Utilities: The Contractor will be responsible to provide utilities to the work area. Connection to existing building utilities and services will require written approval of the Owner. All internal building utility connections will be in compliance with NEC, state and local building codes.
- D. Electric Power: The Contractor shall shut down and lock out electric power to all work areas. The Contractor shall provide temporary power and lighting, and ensure safe installation of temporary power sources and equipment used where high humidity and/or water shall be sprayed in accordance with all applicable codes. All power to work areas shall be brought in through a ground fault interrupter at the source.

- E. Movable Objects: Movable objects within the work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning and such objects shall be removed from the work area to an uncontaminated location. If disposed of as asbestos waste material, cleaning is not required. The Owner shall determine which method is to be utilized.
- F. Pre-cleaning: The work area shall be cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters, are prohibited. Asbestos material shall not be disturbed during pre-cleaning.
- G. Sealing of Partitions: Edges of the partition shall be caulked at the floor, ceiling, walls and fixtures to form an airtight seal.
- H. Plastic Sheeting: The work area side of the partition shall be covered with a double layer of a minimum of six mil fire resistive plastic sheeting with staggered joints and sealed.
- I. Plasticizing/Sealing: Prior to the placement of critical barriers, affected surfaces shall be pre-cleaned using HEPA-filtered vacuum equipment and wet cleaning methods. All openings within the regulated abatement work area shall be sealed with critical barriers installed. For larger work area removals, any operable windows or openings to the building at the work level or on the floor below within twenty five (25) feet of the immediate work area shall be plasticized with 12 NYCRR 56 Subpart 11, Page 107 two (2) layers of six (6) mil fire retardant polyethylene sheeting. The windows can be plasticized outdoors, or for reasons of safety, from the indoors. Window, door, and louver units subject to complete removal must have their openings plasticized at the interior of the building. Windows that are fixed or non-operable and that will remain sealed airtight for the duration of abatement activities, do not require installation of critical barriers.
- J. Drop Clothes: Under areas where non-friable materials are removed without tents, a drop cloth, made of six (6) mil fire retardant polyethylene sheeting, shall be placed on the ground below the work area to prevent spread of any ACM remnants. This drop cloth shall be a minimum of ten (10) feet wide with an additional ten (10) feet of width for every floor above a 1st floor level where removal work will take place, up to a maximum of thirty (30) feet of width measured perpendicular to the building/structure. In addition, if a straight scaffolding, man-lift, swing scaffolding or similar equipment is used for areas above the 1st floor, the lift/scaffolding unit shall be plasticized with two (2) layers of six (6) mil fire retardant polyethylene on the platform, with plastic sheeting extended vertically to waist-high (as so equipped) guardrail sides and back of the lift unit. While the platform/lift walking surfaces must be plasticized, the asbestos abatement contractor must provide proper traction surfaces or equipment to assure the safety and comfort of abatement workers while performing abatement activities on the lift/scaffold equipment. After non-friable ACM is removed from each work location, the platform and plasticized surfaces toward the building shall be wet wiped and/or HEPA vacuumed clean before reuse. The plasticizing on the lift or scaffolding shall be periodically inspected during use and repaired as needed.



- K. Exits: Emergency and fire exits from the work area shall be maintained or alternate exits shall be established according to all applicable codes.
- L. Toilet Facilities: Adequate toilet facilities shall exist either in the clean area of the personal decontamination enclosure or shall be readily accessible to the personal decontamination enclosure.
- M. Changing Area (Clean Room):
  - 1) An isolation changing area shall be provided for the purpose of changing into protective clothing. It shall be constructed using fire resistant polyethylene sheeting, at least 6 mil thick, and located such that access to work area shall be from changing area through the shower.
  - 2) Within changing area, provide suitable locker or acceptable substitute, for storage of each worker's street clothing.
  - 3) Visual Barrier: Where work area is immediately adjacent and within view of occupied areas, a visual barrier of opaque polyethylene sheeting at least 6 mil thick shall be provided so that work procedures are not visible to building occupants. Where area adjacent to work area is accessible to public, construct a solid barrier on public side of sheeting to protect sheeting. Barriers shall be constructed with wood or metal studs covered with minimum 3/8" thick hardboard. Where solid barrier is provided, sheeting need not be opaque.

### 3.03 - WORKER DECONTAMINATION SYSTEM:

- A. Provide a minimum of three totally enclosed chambers, lined with minimum of two layers of 6 mil thick polyethylene sheeting.
- B. Provide an equipment area for storage of equipment (tools, boots, etc.) to be reused in the abatement work and for removal of disposable clothing. Equipment area shall have two curtained airlocks, one leading to work area and one leading to shower area. A minimum of 6' shall be maintained between airlocks.
- C. Provide a shower area containing at least one shower for every six employees with hot and cold water supply controllable at the tap and with waste drainage piped through filters that meet applicable federal, state and local rules, laws and regulations; specifically NESHAP regulations. Contractor is responsible for providing hot water.
- D. Provide a changing area with suitable lockers, or other storage acceptable to the Owner, for storage of each worker's, or authorized visitor's street clothing, towels, clean disposable clothing for use in work area, and other non contaminated items. Provide two curtained airlocks, one leading to uncontaminated areas and one leading to shower area.
- E. Provide separate facilities for each sex.

### 3.04 - EQUIPMENT DECONTAMINATION SYSTEM:

- A. Provide a minimum of two totally enclosed chambers, lined with minimum of two layers of 6 mil thick polyethylene sheeting.
- B. Provide an equipment washroom for cleaning and decontamination of equipment and containers to be removed from work area. Washroom shall have two curtained airlocks, one leading to work area and one leading to holding area. Provide minimum of 6' between airlocks.
- C. Provide a holding area for temporary storage of decontaminated equipment and containers. Holding area shall have two curtained airlocks, one leading to equipment washroom and one leading to uncontaminated areas.

### 3.05 - PERSONNEL PROTECTION PROCEDURES:

- A. Each worker shall be instructed and trained in the hazards of asbestos exposure and in proper use of respirators.
- B. Each worker and authorized visitor shall always wear a respirator, properly fitted on the face, while in the work area until the whole area is completely decontaminated as evidenced by satisfactory final air clearance monitoring results.
- C. In order to enter the work area, each worker or authorized visitor, without exception, shall:
  - 1) Demonstrate their certification to enter the abatement work area and sign the entrance log.
  - 2) Remove street clothes in changing area and put on new disposable coveralls, new head covers, new footwear covers, and a clean respirator with fresh filters each time the work area is to be entered. Perform positive and negative field fit test.
  - 3) If non-disposable footwear is to be used, personnel shall proceed to the equipment area and put on non-disposable footwear therein.
- D. Upon leaving the work area, each worker and/or authorized visitor, without exception, shall:
  - 1) Remove gross contamination in work area before entering equipment area. Once inside equipment area, remove disposable coveralls, disposable head covers, and disposable footwear covers or non-disposable footwear before leaving equipment area.
  - 2) Still wearing respirator, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing respirator and filters to avoid breathing asbestos fibers while showering. The following procedures are required:
    - a) Thoroughly wet body from neck down.
    - b) Wet hair as thoroughly as possible without wetting respirator filter.
    - c) Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter. While still holding breath, remove respirator and hold it away from face before starting to breathe.
    - d) Dispose of wet filter in container provided in shower.
    - e) Shower completely with soap and water.

- f) Rinse thoroughly.
- 3) Shower each time before entering changing area to change into street clothes or into new disposable work items.
- 4) NOTE: Seriously injured persons may be removed from the work area without following the above decontamination procedure. Follow posted instructions.
- E. Workers shall not eat, drink, smoke, chew gum, or tobacco in the work area. To eat, drink, or smoke, workers shall follow procedure described above, then dress in street clothes before entering non work areas of building.
- F. Disposable coveralls, head covers, and footwear covers shall be provided to the Owner, air monitoring technician and others as authorized representatives of the project manager or Owner who may inspect the job site; approximately four complete outfits per day.
- G. Personal Air Monitoring: Contractor will be responsible for personal air monitoring of workers, and providing results to the Owner within 24 hours for necessary actions that may be required.

### 3.06 - EQUIPMENT REMOVAL PROCEDURES:

- A. All equipment and containers in the work area shall remain in the work area until daily completion of asbestos removal activities. When daily abatement work is completed, equipment and containers shall be removed as follows:
- B. While still in work area, clean all external surfaces of equipment and containers by wet sponging or HEPA vacuum.
- C. After gross decontamination in work areas, move equipment and containers into airlock, then into equipment room for complete decontamination. Workers shall not cross airlock.
- D. When decontamination in equipment wash room is complete, move cleaned equipment and containers into airlock, then into holding area. Do not exit holding area to uncontaminated areas directly; return to work area and exit through worker decontamination system.
- E. Periodically, workers dressed in clean disposable coveralls shall enter the holding area from uncontaminated areas to remove clean equipment and containers. Do not enter equipment wash room when removing equipment and containers.

### 3.07 - ASBESTOS REMOVAL (GENERAL):

- A. Apply a fine spray of amended water to the asbestos before removal. Saturate the asbestos sufficiently to prevent emission of airborne fibers in excess of the exposure limits prescribed of OSHA standards.
- B. Remove the asbestos in small sections. Perform the work with two-person teams. Use staging platforms if necessary.
- C. Large components and sharp-edged components shall be removed from the work area and sealed airtight in fiber drums prior to disposal in dumpsters. Dispose in accordance

with USEPA and NYSDEC requirements.

- D. While the removed asbestos is still moist, place it into plastic bags (6 mil minimum). Do not remove more asbestos than can be bagged immediately, to prevent drying. Seal each bag.
- E. Frequency for Containerizing. Cleanup of accumulations of loose asbestos material shall be performed whenever enough loose asbestos material has been removed to fill a single leak tight container of the type commensurate with the material properties. In no case shall cleanup be performed less than once prior to the close of each working day. Asbestos material shall be kept wet until cleaned up.
- F. Frequency for Cleaning of Dust. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum and/or wet cleaning methods.
- G. Frequency for Cleaning of Enclosures. Decontamination enclosures shall be HEPA vacuumed and/or wet cleaned at the end of each shift.
- H. Cleanup Tools and Equipment. Accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dustpans, squeegees or shovels. Metal shovels shall not be used to pick up or move waste.
- I. Remove sealed bags to load out area, wipe the bags off and place in second disposal bag. Seal outer bag, wet wipe exterior of second bag before loading.

### 3.08 - ACM PACKAGING:

- A. Asbestos containing materials which are stripped away, or otherwise removed, shall be packed while still wet, into six mil plastic bags. The bags shall be sealed, prepared and placed in the container for transport. The outside of all bags shall be cleaned before leaving work area. Periodic clean up and bagging of removed materials, while still wet, and used coveralls, head-cover, etc., shall be done to prevent accumulation of such material on the floor covering Contractor shall limit traffic in the area which may cause excessive airborne concentrations of the fibers. Stripped material shall be sprayed as necessary to keep it wet until clean up.
- B. Bags shall be in accordance with section 2.02 C and all other applicable rules, laws and regulations.
- C. Bags, drums, or other containers shall be removed from the work area in accordance with Section 3.06 "Equipment Removal Procedures".

### 3.09 - FINAL ABATEMENT CLEAN-UP:

- A. Remove visible accumulations of materials and debris. Wet clean all surfaces within the work area and within worker/equipment decontamination enclosure system. Sealed drums, bags, and all equipment used in the work area shall be included in the clean up and shall be removed from work area areas, via the equipment decontamination enclosure system, at an appropriate time in the cleaning sequence.

- B. Frequency for Containerizing. Cleanup of accumulations of loose asbestos material shall be performed whenever enough loose asbestos material has been removed to fill a single leak tight container of the type commensurate with the material properties. In no case shall cleanup be performed less than once prior to the close of each working day. Asbestos material shall be kept wet until cleaned up.
- C. Frequency for Cleaning of Dust. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum and/or wet cleaning methods.
- D. Frequency for Cleaning of Enclosures. Decontamination enclosures shall be HEPA vacuumed and/or wet cleaned at the end of each shift.
- E. Clean-Up Tools and Equipment. Accumulations of asbestos waste material shall be containerized using HEPA vacuums or rubber or plastic dustpans, squeegees or shovels. Metal shovels shall not be used to pick up or move waste.
- F. The visual inspection shall be performed under conditions of adequate lighting provided by the contractor. The work area shall be free of visible debris.
- G. Repeat the cleaning process as described if either the visual inspection criteria or air monitoring clearance levels are not satisfied.

### 3.10 - QUALITY ASSURANCE:

- A. The scope of abatement work does not include asbestos abatement that requires environmental air monitoring in accordance with State and Federal regulations. Should an instance occur that changes the expected parameter of this asbestos abatement project to an extent where environmental air monitoring shall be required to comply with State and

### 3.11 - RESPONSIBILITIES AND DUTIES OF CONTRACTOR:

- A. To facilitate testing services, the Contractor shall:
- B. Advise the Owner and the testing agency sufficiently in advance of operations to allow for completion of tests and for the assignment of personnel.
- C. Ensure the cooperation of the employees and superintendent with the air sampling technician.
- D. The Contractor shall hold harmless the Building Owner, Construction Manager and Project Monitor for New York State Department of Labor, EPA and OSHA fines and fees resultant from activities of the Contractor. The Contractor shall be 100% responsible for all regulatory compliance. When other parties such as the Project Monitor, Owner and/or Construction Manager are fined, levied or otherwise caused monetary loss due to the Contractor's action and/or lack of action, said Contractor shall reimburse the entire loss to the affected party. The actual reimbursement shall occur within 30 days of the fine being

levied. The failure of the Owner, Project Monitor and/or Construction Manager to enforce the Contractor's regulatory compliance shall in no way relieve the Contractor of responsibility for maintaining such regulatory compliance, or for the reimbursement of fines resulting from their non-compliance. The Contractor shall authorize that money may be withheld from the contract sum in sufficient quantity to reimburse the affected party.

### 3.12 - ADDITIONAL TESTING:

- A. The Contractor may conduct its own area air monitoring and laboratory testing. If it elects to do this, the cost shall be included in the contract price(s).
- B. If it is necessary to re-sample work areas for clearance testing because the area does not meet the clearance standards, the abatement contractor shall incur all costs for this additional sampling and lab analysis.

### 3.13 - DISPOSAL OF ASBESTOS MATERIAL AND RELATED DEBRIS (GENERAL):

- A. Properly containerized waste must be transported by a licensed hauler and shipped to an approved landfill. Waste manifests must show chain of custody. Provide one copy of the waste manifests to the Owner.
- B. All contaminated waste shall be carefully loaded on trucks or other appropriate vehicles for transport. Before and during transport, care shall be exercised to insure that no unauthorized persons have access to the material.
- C. Transporters of the waste are prohibited from "back hauling" any freight after the disposition of the Owner's waste stream until decontamination of the vehicle and/or trailer is assured.

### 3.14 - WASTE MANAGEMENT AND DISPOSAL (SPECIFIC):

- A. The Contractor shall be responsible for all packaging, labeling, transport, disposal and record-keeping associated with asbestos containing waste in accordance with all federal, state and local regulations.
- B. The Contractor shall be responsible to remove all non ACM debris, rubbish and other materials to be disposed of as non ACM waste resulting from operations produced on the job site and dispose of it in accordance with all state and local regulations.
- C. All asbestos containing materials will be sufficiently wet to prevent any visible emission of dust into the air. The Contractor shall examine the asbestos containing waste material at a minimum every 24 hour period to assure that containers and packaging has not been damaged. If packaging has been damaged, materials will be wetted and repackaged.
- D. The Contractor shall ensure that the person transporting the waste holds a valid permit issued in accordance with appropriate federal, state, and local regulations.
- E. The Contractor shall provide to the transporter at the time of transfer appropriate shipping

records as required by the federal, state and local regulations with a copy to the project engineer.

- F. Contractor shall maintain proper follow up procedures to assure that waste materials have been received by the designated waste site in a timely manner and in accordance with all federal, state and local regulations.
- G. The Contractor shall assure that disposal of ACM is at a landfill approved to accept asbestos containing waste and shall provide to the Owner, a fully executed waste shipment record signed by the landfill's owner as having accepted the shipped waste

## SECTION 028333 - REMOVAL OF MATERIALS CONTAINING LEAD

### PART 1 - GENERAL

#### 1.01 - RELATED CONTRACTORS:

- A. General Contractor will advise all other contractors, subcontractors and trades of the presence of LBP and coordinate all work accordingly.

#### 1.02 - DESCRIPTION OF WORK:

- A. This section specifies the procedures for the removal and/or disturbance of lead-based paint and/or lead painted/glazed components and disposal of removed materials.

#### 1.03 - SCOPE OF WORK:

- A. All work under this contract shall be performed in strict conformance with applicable federal, state and local rules, laws and regulations.
- B. The specifications are to be used in conjunction with the contract drawings for this project. A copy of each is to be maintained at the job site at all times.
- C. Contractors shall verify all project conditions and material quantities prior to bidding the project. Material quantities listed in any documents provided by the Owner are approximations only and are NOT TO BE considered accurate for bidding purposes.
- D. The contractor shall furnish all labor, materials, services, employee training, permits, insurance, and equipment to remove lead-based paint and/or components covered with lead-based paint in locations indicated as follows:
- E. General Notes:
  - 1) All Lead removal and subsequent clean up activities shall be performed in accordance with these specifications and all applicable OSHA and USEPA Regulations and the HUD Guidelines as indicated in section 1.8.
  - 2) Waste Disposal Requirements shall be determined by sampling of a composite of the waste material for analysis by TCLP.
  - 3) The Owner's Representative shall conduct TCLP sampling for Waste Stream classification and HUD approved clearance sampling prior to re-occupancy in accordance with the NYS Education Dept. Mandate of Oct 3, 1999.
- F. Specific Notes:
  - 1) The following building components in the areas of renovation were determined to be lead containing, or otherwise coated with lead based paint/glaze:
  - 2) LAKE SHORE HIGH SCHOOL:
    - a) Structural Steel
- G. Where these components must be disturbed/handled as part of renovation/construction activities, such disturbance shall be take place as follows. Place poly dropcloths on the floor/ground under areas of removal to collect any lead dust/chips/debris that may fall during removal operations. Utilize barrier tape to cordon off the work area to restrict access by unauthorized persons. At the conclusion of removal activity, the contractor shall properly dispose of all removed material and contaminated poly sheeting.



Disturbance shall be in accordance with all applicable OSHA, EPA and HUD regulations and guidelines.

#### 1.04 - QUALITY ASSURANCE:

- A. Use latest edition, including all addenda, revisions and supplements for all regulatory agencies codes, etc., including but not limited to:
  - 1) Environmental Protection Agency (EPA).
  - 2) Occupational Safety and Health Administration.
  - 3) State of New York codes and laws.
  - 4) All local codes.
  - 5) US-DOT 49 CFR.
  - 6) Guidelines for the Evaluation and Control of Lead-based Paint Hazards in Housing (US Department of Housing and Urban Development)

#### 1.05 - QUALIFICATIONS:

- A. The following qualifications must be met by all prospective bidders:
  - 1) Contractor Experience:
  - 2) Contractors that engage in activities that may impact or disturb lead painted, glazed or coated surfaces shall be licensed to perform such activities in Schools Constructed before 1978 and areas identified as child occupied facilities in accordance with USEPA 40 CFR Part 745, the Lead Renovation, Repair and Painting Program.
  - 3) List the name and location of at least five environmental lead removal and/or disturbance projects of similar scope and nature.
- B. If during the life of this project New York State shall enact regulations covering Lead Based Paint removal, the Contractor shall comply with same and obtain certification and licensing as required, at no additional cost to the Owner.
- C. All contractor personnel who will participate in activities that may generate airborne concentrations of lead shall have at a minimum, such training as specified in OSHA 20 CFR 1926.62. Prior to starting the activities that may generate airborne concentrations of lead, provide workers with blood lead testing in accordance with OSHA 29 CFR 1926.62.

#### 1.06 - REGULATIONS:

- A. All work under this contract shall be done in strict accordance with all applicable federal, state, and local regulations, standards, and codes governing lead removal and any other trade work done in conjunction with the removal.
- B. The most recent edition of any relevant regulation, standard, document, or code shall be applicable to the work. Where conflict among the requirements or with these specifications exists, the most stringent requirements are applicable.
- C. Copies of all standards, regulations, codes, and other applicable documents and subsequent amendments thereto, listed in this section and including this specification, shall be available at the work site.

#### 1.07 - SPECIFIC REQUIREMENTS

- A. New York State Education Department (NYSED)
  - 1) NYSED regulations governing lead removal include, but are not limited to:
    - a) sections 101, 207, 409-d, 409-e, 3602 and 3641 of the Education Law
    - b) Chapters 56 and 58 of the Laws of 1998.

- c) Section 155.1 of the Regulations of the Commissioner of Education, amended, effective October 7, 1999.
- B. Occupational Safety and Health Administration (OSHA)
  - 1) OSHA regulations governing lead removal include, but are not limited to:
  - 2) Title 29 CFR 1910.1025- LEAD, not applicable to the construction industry.
  - 3) Title 29 CFR Section 1910.134, general industry standard for respiratory protection.
  - 4) Title 29 CFR Section 1910.20, access to employee exposure and medical records.
  - 5) Title 29 CFR Section 1910.1200, hazard communication.
  - 6) Title 29 CFR Section 1910.145, specifications for accident prevention signs and tags.
  - 7) Title 29 CFR Section 1910.95, noise regulation.
  - 8) Title 29 CFR Part 1926.62, Lead Exposure in Construction; Interim Final Rule
- C. Environmental Protection Agency (EPA)
  - 1) EPA regulations governing hazardous waste disposal include, but are not limited to:
    - a) 40 CFR Part 260, Definitions.
    - b) 40 CFR Part 261, Section 3001: Identification and Listing of Hazardous Waste.
    - c) 40 CFR Part 262, Section 3002: Standards Applicable to Generators of Hazardous Waste.
    - d) 40 CFR Part 263, Section 3003: Standards Applicable to Transporters of Hazardous Waste
    - e) 40 CFR Part 264, Section 3004: Final Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
    - f) 40 CFR Part 267, Temporary Standards for Land Disposal Facilities.
    - g) 40 CFR Part 268, Land Disposal Restrictions.
    - h) 40 CFR Part 270, 271 & 124, Section 3005: Permits for Treatment, Storage and Disposal of Hazardous Wastes.
    - i) 40 CFR Part 745 Lead; Renovation, Repair and Painting Program
- D. American National Standards Institute (ANSI)
  - 1) ANSI standards governing lead removal include, but are not limited to:
    - a) fundamentals governing the design and operation of local exhaust systems, Publication 29.2-79.
    - b) practices for respiratory protection, Publication Z88.2-80.
- E. Mine Safety and Health Administration (MSHA)
  - 1) Certification of respirators as per 30 CFR Part 11.
- F. National Institute for Occupational Safety and Health (NIOSH)
  - 1) NIOSH regulations governing lead removal include, but are not limited to:
    - a) approval of respirators as per 30 CFR PART 11.
- G. New York State Requirements
  - 1) State regulations governing Hazardous Waste Disposal include, but are not limited to:
  - 2) 6 NYCRR Part 371, Identification and Listing of Hazardous Wastes, December 25, 1988.

- 3) 6 NYCRR Part 373-2, Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, December 25, 1988.
- 4) 6 NYCRR Part 360, Solid Waste Management Facilities, Revised March 27, 1990.
- H. Department of Transportation
  - 1) CFR Parts 171-179.
- I. Department of Housing and Urban Development
  - 1) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing. June 1995.
- J. Licenses
  - 1) Maintain current licenses as required by applicable federal state or local jurisdictions for the removal, transportation, disposal, or other regulated activity relative to the work of this Contract.
- K. New and Amended Regulations
  - 1) Any and all new or amended federal, state, or local regulations becoming effective during this project and not listed are to be considered as part of this specification. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source. Although certain copies of standards needed for enforcement of the requirements may be required submittals, the owner's representative reserves the right to require the Contractor to submit additional copies of these standards as necessary for enforcement of the requirements.

#### 1.08 - DEFINITIONS:

- A. Action Level: Employee exposure, without regard to respiratory protection, to an airborne concentration of lead of thirty (30) micrograms per cubic meter of air, as an 8 hour time weighted average, measured in the breathing zone as defined by 29 CFR 1926.62.
- B. Hazardous Waste: including contaminated material, which after testing by the Toxicity Characteristic Leaching Procedure (TCLP), the leachate contains any element in excess of the following
 

|                 |                  |
|-----------------|------------------|
| Arsenic 5 mg/l  | Barium 100 mg/l  |
| Cadmium 1 mg/l  | Chromium 5 mg/l  |
| Lead 5 mg/l     | Mercury 0.2 mg/l |
| Selenium 1 mg/l | Silver 5 mg/l    |
- C. Lead Based Paint: Paint under laboratory analysis that contains 0.5% by weight or greater, elemental lead; Paint analyzed by XRF that contains lead equal to or greater than 1.0 mg/cm<sup>2</sup>.
- D. Lead Work Area: That area where lead disturbance operations are performed which is isolated by physical boundaries that assist in the prevention of uncontrolled release lead dust or particles.
- E. Permissible Exposure Limit: Employee exposure, without regard to respiratory protection, to an airborne concentration of lead of fifty (50) micrograms per cubic meter

of air, as an 8 hour time weighted average, measured in the breathing zone as defined by 29 CFR 1926.62.

- F. Regulated Area: Area(s) where lead work is conducted as defined by 29 CFR 1926.62.

#### 1.09 - SUBMITTALS:

- A. The Contractor shall submit electronic versions of all submittals via Master Library.
- B. Each submittal shall be reviewed through Master Library and returned to the Contractor with the following notation:
- 1) Rejected-Revise and Resubmit: The Contractor shall make the necessary corrections to the submittal or select alternate removal methods, materials, and/or equipment and resubmit 5 complete copies.
  - 2) Approved as noted: The Contractor may proceed with removal method, materials and/or equipment in accordance with the changes/requirements noted on the submittal. The Contractor shall resubmit copies of the submittal indicating compliance with notations prior to final payment.
  - 3) Approved: The Contractor may proceed with the project and use of removal method, materials and/or equipment.
- C. The Contractor shall not proceed with removal method, materials and/or equipment prior to receipt of approval. Any removal method, material and/or equipment used which are not in compliance with “approved” or “approved as noted” shall be at no cost to the Owner.
- D. The contractor shall provide certified copies of the following:
- 1) A letter indicating all labor force has passed a physical exam for use of a respirator and provide copy of qualitative fit test for all personnel, posted at the project site.
  - 2) A letter indicating completion of training and certification of all employees to be associated with project and copy of same posted at project site.
  - 3) Copies of Medical Doctor’s release, including statement that workers blood lead levels are within acceptable limits.
  - 4) Copies of written respiratory program and qualitative respirator fit test.
  - 5) A written description (with sketches if required) to address project scheduling and details of all required enclosures, barriers, etc. Indicate dimensions of all personal and waste decontamination systems, and locations of all enclosures.
- E. Certified list of the following:
- 1) Required permits.
  - 2) disposal site location.
  - 3) agreement for disposal.
  - 4) waste hauler permit specifically for lead.
  - 5) Transporter Permits: DEC permit and permit(s) as required by county (s) through which the lead contaminated waste and recycled material is transported to TSDF and/or recycling facility.
- F. Manufacturer’s Data:
- 1) Submit copies of manufacturer’s specifications, recommendations and installation instructions for encapsulation, and associated miscellaneous material required. Include manufacturer’s published data, or letter of

certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

- 2) Lead Specific Cleaners: submit product data; use instructions and recommendations from manufacturer of surfactant intended. Include data substantiating that material complies with requirements.
- 3) Paint/Encapsulant: submit product data; use instructions and recommendations from manufacturer of paint intended for use. Include data substantiating that material complies with requirements.
- 4) Material Safety Data Sheet: submit the material safety data sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each product used in this project. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

G. Following the completion of removal activities, the Contractor shall submit the following Project Close-Out Documentation:

- 1) Work area daily entry/exit logs.
- 2) Contractor Supervisor's daily activity logs.
- 3) Personnel paperwork for each Employee actually utilized on project including:
  - a) Copy of valid respirator fit test issued within the twelve-month period preceding the conclusion of removal.
  - b) Copy of Certifying Physicians report indicating ability to safely don respiratory protection issued within the previous 12-month period.
  - c) An affidavit indicating completion of training and certification of each Contractor's employee employed on the project.
- 4) Personal Sampling Records for the project.
- 5) All receipted waste shipment records and completed trucking/manifest forms, which have been signed and certified by the Landfill's Owner/Manager as having accepted the shipped waste.

#### 1.10 - JOB CONDITIONS:

- A. Posting of regulations: Display the following in the clean changing area, in public view, for the full duration of the work:
- 1) OSHA Regulation 29 CFR 1926.62.
  - 2) Instructions for removing injured persons from work area.
  - 3) Post emergency action plan at the work site. This plan shall also include telephone numbers for hospital, doctor and fire company.
  - 4) Provide Sign In and Out sheets for all persons entering the work area.

### PART 2 - PRODUCTS AND PROCEDURES

#### 2.01 - REMOVAL PRODUCTS

- A. Polyethylene Sheeting
- 1) Polyethylene Sheeting shall be at least 6-mil thickness, in widths selected to minimize joints.
  - 2) Polyethylene sheeting utilized for worker decontamination enclosure shall be opaque white.
  - 3) All polyethylene sheeting shall be fire rated.

- B. Attachment Materials for Polyethylene: Method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and Owner and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of duct tape or other waterproof tape, furring strips, spray glue, staples, nails, screws, or other effective procedures capable of sealing adjacent sheets of polyethylene and capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions (including the use of amended water).
- C. Disposal Bags: 6 mil polyethylene, pre-printed with labels as required by this specification shall contain the following information:

DANGER  
CONTAINS LEAD DUST  
AVOID CREATING DUST  
OWNER  
EPA SITE #

- D. Disposal Drums: metal or fiberboard with locking ring tops, warning labels as required by OSHA, EPA and DOT.
- E. Stick-On Labels: per OSHA Requirements.
- F. Surfactant (Wetting Agent): 50/50 mixture of Polyoxyethylene Ether and Polyoxyethylene Ester, or equivalent, mixed in a proportion of 1 fluid ounce to 5 gallons of water or as specified by manufacturer. (An equivalent surfactant shall be understood to mean a material with a surface tension of 29 dynes/cm as tested in its properly mixed concentration, using ASTM Method D1331-56 "Surface and Interfacial Tension of Solutions of Surface Active Agents"). Where work area temperature may cause freezing of the amended water solution, the addition of Ethylene Glycol in amounts sufficient to prevent freezing is permitted.
- G. Encapsulating Agent: provide an encapsulant specifically designed for application to lead based paint. All materials used shall have a flame spread of less than 25 when dry (when tested in accordance with ASTM-84).

## 2.02 - GENERAL EQUIPMENT

- A. A sufficient supply of disposable mops, rags, and sponges for work area decontamination shall be available.
- B. A sufficient supply of scaffolding, ladders, lifts, and hand tools, (e.g., scrapers, wire cutters, brushes, utility knives, wire saws, tarps etc.) shall be provided as needed.
- C. Low pressure or airless sprayers.
- D. Rubber dustpans and rubber squeegees.
- E. Brushes utilized for removing loose lead based paint shall have nylon or fiber bristles, not metal.
- F. HEPA filtered vacuum cleaners with attachments.
- G. Water drain filters: AP-2000 by Creative Innovation or approved equal.

## 2.03 - PERSONNEL PROTECTION

- A. Related Requirements Specified Elsewhere.
  - 1) Regulatory requirements - Section 1.06
  - 2) Personnel protection procedures - Sections 2.05, 2.06, 2.07, 2.08, 2.09

3) Equipment removal procedures - Section 3.09

2.04 - RESPIRATORY PROTECTION EQUIPMENT

- A. Respirators shall be provided to ensure that the workers are not exposed to lead in air concentrations above the PEL of 50 micrograms/cubic meter, 8 Hour TWA. The rules in 29 CFR 1910.1025 shall govern the respirator selection as described in Section 2.8. The same type respirator filters used for asbestos removal may be used for lead based paint removal except when using caustic strippers or heat method or any other removal method that may release lead fumes as well as lead dust. When lead fumes may be present a combination filter for organic vapors and particulate matter must be used. Respirators must be worn performing any of the tasks described in 29 CFR part 1926, Lead Exposure in Construction; Interim Final Rule.
- B. A sufficient supply of charged replacement batteries and high efficiency filters and a flow test meter shall be available in the clean change area for use with powered air purifying respirators.
- C. Spectacle kits and eyeglasses must be provided for employees who wear glasses and who must wear full-face piece respirators.
- D. A sufficient supply of high efficiency filters shall be available for all air purifying respirators.

2.05 - PROTECTIVE CLOTHING

- A. A sufficient supply of cloth protective coveralls with full sleeves and full legs shall be supplied by the contractor to all employees. The contractor shall either supply a full work week supply of cloth coveralls or arrange for laundry service to provide a clean coverall for each employee on each work day. It will be the contractor's responsibility to launder the coveralls at the end of each week and provide clean coveralls for the following week. In either case laundry procedures shall be in compliance with all local, state and federal regulations. A new disposable painters cap or equivalent shall be supplied by the contractor in a quantity sufficient to provide a new cap for each employee each day. Disposable Tyvek or equivalent coveralls can be used in place of cloth coveralls.
- B. Additional safety equipment (e.g., hard hats meeting the requirements of ANSI Standard Z89.1-1981, eye protection meeting the requirements of ANSI Standard Z87.1-1979, safety shoes meeting the requirements of ANSI Standard Z41.1-1967, disposable PVC gloves or other work gloves), as necessary, shall be provided to all workers and authorized visitors.
- C. Nonskid rubber footwear shall be provided to all removal workers.

2.06 - TRAINING

- A. All employees shall have completed at a minimum, training in accordance with 29 CFR 1926.62.
- B. Supervisory personnel shall be competent people and have previous experience as supervisors of lead removal personnel.

2.07 - RESPIRATORY PROTECTION

- A. All respiratory protection shall be provided to workers in accordance with the submitted written respiratory protection program, which includes all items in OSHA 29 CFR

1910.134 (B), (D), (E), and (F). This program shall be posted in the clean room of the worker decontamination enclosure system.

B. Workers shall be provided with personally issued, individually identified (marked with waterproof designations) respirators.

C. Workers shall be provided with respirators that meet the following criteria:

| <u>Lead Concentration</u>                        | <u>Removal Methods</u>                                                                                                                             | <u>Required Respirator</u>                                                               |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Not in excess of 500<br>µg/cubic meter (10XPEL)  | Manual Demolition<br>Manual Scraping<br>Manual Sanding<br>Heat Gun Use<br>Power too paint removal in the HEPA vacuum-assist dust collection system | Half mask air purifying respirator<br>Equipped with high efficiency filters.             |
| Not in excess of 2500<br>µg/cubic meter (50XPEL) | Cleanup on dry, abrasive blasting jobs<br>Abrasive blasting enclosure movement/removal                                                             | Full face-piece, powered air-purifying respirator equipped with high efficiency filters. |
| Greater than 2500<br>µg/cubic meter,             | Abrasive Blasting                                                                                                                                  | Full face-piece, self-contained breathing apparatus operated in positive pressure mode.  |

D. When air tests show the level of lead in air exceeds 30-micrograms/cubic meter TWA, (The Action Level), the Contractor will begin respiratory protection and personnel monitoring. At minimum, half-face air purifying respirators will be worn during all preparation and cleaning operations. Respirators must be worn performing any of the tasks described in 29 CFR part 1926, Lead Exposure in Construction; interim Final Rule.

E. During all removal operations, the minimum level of protection required is the half-face air-purifying respirator.

F. Fit Testing

- 1) Workers must perform positive and negative air pressure fit checks each time a respirator is put on, whenever the respirator design so permits. Powered air-purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- 2) Workers shall be given a qualitative fit test in accordance with procedures detailed in the OSHA Regulation (29 CFR 1926.58, Appendix C, Qualitative and Quantitative Fit Testing Procedures) for all respirators to be used on this removal project. The irritant fume protocol will be utilized. An appropriately administered quantitative fit test may be substituted for the qualitative fit test.

G. No one wearing a beard or other facial hair, which will reduce the performance of the respirator, shall be permitted to don a respirator and enter the work area.

## 2.08 - MEDICAL SURVEILLANCE

A. Medical surveillance must be provided by the Contractor to any employee or agent working on this project in accordance with 29CFR Part 1926 (Lead Exposure in Construction). Blood lead levels of each employee on this project will be submitted for



review before commencement, and every two months. No worker or supervisor will be allowed to work on this project while blood lead levels are over 30 micrograms / deciliter.

#### 2.09 - VISITOR CLOTHING:

- A. Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear as described herein, whenever they are required to enter the work area.

#### 2.10 - PERSONAL AIR MONITORING:

- A. Contractor will be responsible for personal air monitoring of workers, and results given to the Owner's Representative.

#### 2.11 - ENVIRONMENTAL MONITORING:

- A. The Owner will engage the services of an environmental testing firm to conduct clearance swipe sampling, TCLP and Waste Water Discharge sampling.
- B. Clearance wipe sampling is required by NYSED for all areas where LBP disturbances take place prior to re-occupancy by school district personnel or students. These testing services shall be performed under a separate third party contract with the Owner's Representative. Clearance wipe samples shall be considered to be satisfactory when the results are less than 40 micrograms per square foot on floors, 250 micrograms per square foot on window sills and 400 micrograms per square foot on window troughs.

### PART 3 - - EXECUTION

#### 3.01 - GENERAL:

- A. Cordon off entire work area with danger tape or fences to prevent entry of unprotected persons. Always provide a means of ingress/egress for building occupants.
- B. Establish emergency and fire exits from the work area as part of the written emergency action plan.

#### 3.02 - PREPARATION - WORK AREAS:

- A. Cordon off work area with contractor fencing or warning tape. The work area shall be described as the exterior building perimeter extending out from the building a distance of no less than 20 feet.
- B. Place two layers of six mil. fire retardant polyethylene sheeting weighted at corners and edges or one layer of rubber roofing weighted at corners and edges or one layer of Permalon or equivalent weighted at corners and edges or canvas tarp weighted at corners and edges on the ground below the area to be worked on to cover the entire work area.
- C. Access to the work area shall be through a restricted entrance area only.
- D. Signs: Caution signs shall be posted at all locations and approaches to a location where airborne concentrations of lead dust may exceed ambient background levels. Signs shall be conspicuously posted that allow a person to read the sign and take the necessary protective measures to avoid exposure.
- E. Utilities: The Owner will provide electrical and water utilities. The Contractor shall provide a sufficient supply of power cords and ground fault circuit interrupters. The

- contractor shall be responsible for making connections to the electric and water supply. Only certified electricians and plumbers shall conduct electrical and plumbing work.
- F. Exits: Emergency and fire exits from the work area shall be maintained or alternate exits shall be established according to all applicable codes.
  - G. Toilet Facilities: Adequate toilet facilities shall exist either in the clean area of the personal decontamination enclosure or shall be readily accessible to the personal decontamination enclosure.
  - H. Contractors shall utilize engineering controls such as negative pressure ventilation equipment, wet methods, chemical peels and HEPA vacuums and equipment to minimize airborne dust levels.
  - I. At a minimum, the following work practices shall be followed for demolishing or disturbing lead painted Door Casings (Man Door and Overhead Door), lintels, metal window components wood doors, porcelain sink, etc.:
    - 1) A drop cloth (single layer of six mil poly sheeting) shall be placed under and around the component, wall and/or ceiling that is being removed.
    - 2) Barrier Tape and Warning Signs shall be placed at the entrance to each area where work is occurring.
    - 3) A curtain constructed of 6 mil polyethylene sheeting shall be constructed around the component being removed or scraped, or the doorway to the room where work will occur shall be sealed with a curtained doorway consisting of three interlocking layers of 6 mil plastic sheeting.
  - J. All horizontal surfaces in the areas where the components have been removed shall be thoroughly cleaned prior to wipe samples being collected.
  - K. At a minimum, the following work practices shall be followed for the removal of paint from structural steel, OHD Door Frames, Lintels, etc., as required.
    - 1) Barrier Tape and/or warning signs shall be placed where work is occurring to restrict access by unauthorized persons.
    - 2) In areas where paint will be removed from structural steel, OHD Door Frames, Lintels, etc. a tent enclosure shall be constructed of 6 mil polyethylene sheeting.
    - 3) HEPA Filtered, negative pressure ventilation equipment shall be installed and operated within the tent to help reduce dust levels. The air shall be exhausted to the exterior of the building.

### 3.03 - ADVERSE WEATHER CONDITIONS:

- A. Work shall not take place during periods when precipitation is likely unless provisions are made to keep rainwater from mixing with lead contaminated dust and debris. Any accumulations of water in the work area shall be cleaned immediately and disposed of in accordance with all applicable state and federal regulations.
- B. Exterior work shall not take place during periods when high wind is likely to cause dispersal of dust and debris. Halt removal procedures if wind is greater than or equal to 15 MPH.

### 3.04 - FINAL REMOVAL CLEAN-UP:

- A. Remove visible accumulations of materials and debris. HEPA vacuum all surfaces within the work area and within worker/equipment decontamination enclosure system, wet clean, then HEPA vacuum again. Sealed drums, bags, and all equipment used in the work area shall be included in the clean up and shall be removed from work area.

- B. Frequency for Cleaning of Dust. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum and/or wet cleaning methods. Removal work shall stop in time to thoroughly clean work area at the end of each shift.
- C. Frequency for Cleaning of Enclosures. Decontamination enclosures shall be HEPA vacuumed and/or wet cleaned at the end of each shift.
- D. Clean-Up Tools and Equipment. Accumulations of lead contaminated materials shall be containerized utilizing HEPA vacuums or rubber or plastic dust pans, squeegees or shovels. Metal shovels shall not be used to pick up or move waste.
- E. Contractor shall clean all surfaces with wet method wiping and HEPA-filtered vacuum equipment; this will include the cleaning of Contractor's equipment, after cleaning the work area.
- F. A visual inspection shall be performed by the Owner's Environmental Consultant under conditions of adequate lighting provided by the Contractor. The work area shall be free of visible debris.

### 3.05 - QUALITY ASSURANCE:

- A. The project monitor or owner's representative will inspect each surface treated under this specification. The Contractor will bring into compliance any unsatisfactory conditions as noted by the project monitor within 24 hours of such notice. The contract will be complete only when all conditions of this specification have been met to the satisfaction of the project monitor, architect and building owner.
- B. The Contractor shall be responsible for all costs, including all re-cleaning and all project monitoring, re-sampling and analysis costs associated with failure of post removal clearance sampling. The Contractor shall re-clean all unsatisfactory areas until successful clearance dust wipe sampling is achieved.

### 3.06 - ON-SITE STORAGE OF DEBRIS:

- A. All on-site storage of hazardous waste/materials shall conform to the applicable regulations of all Federal, State and local agencies having jurisdiction in such matters, in addition to the other provisions of this document.
- B. All debris shall be stored and secured in a locked dumpster or disposal trailer.
- C. Debris shall not be stored in any building at the site.
- D. Non-hazardous debris (construction demolition) shall be stored in a covered dumpster and removed on a weekly basis or more often, unless otherwise specified in writing by the owner or owners representative.
- E. The placement of all dumpsters, trailers, or other storage shall be done with the Owner's approval. Waste trailer/dumpster locations may be remote from the work area. The contractor shall make provisions to move waste from the work area to the waste trailer.
- F. Conditions caused by the storage of such materials affecting the health and safety of the public including but not limited to fire, dust or vermin, shall be grounds to require the Contractor to remove, relocate, or take other control measures to correct the condition at the Contractor's expense.

### 3.07 - DISPOSAL OF NON-HAZARDOUS WASTE:

- A. All disposal of waste shall conform to the regulations of all Federal, State and local agencies having jurisdiction.
- B. The contractor shall submit to the owner proof of proper disposal consisting of dump tickets from an approved landfill. Proof of proper disposal must be submitted on an ongoing basis and prior to or at the same time as applications for payment. The contractor will not be paid until proof of proper disposal is submitted.

- C. Non hazardous waste including any testing of waste shall be disposed of by the contractor at the contractor's expense.
- D. Testing of lead based paint debris, not inclusive of construction and demolition debris as defined by EPA, shall be tested by TCLP for waste characterization by the Third Party Environmental Monitoring Firm.

3.08 - HAZARDOUS WASTE – LEAD:

- A. Hazardous Wastes/Lead Waste - Liquid:
  - 1) No water or solvents shall be discharged into any waterway, sewer or on the ground without testing by an approved Laboratory retained by the Contractor for this purpose.
  - 2) All liquid waste shall be disposed of by the contractor at the contractor's expense. The contractor shall be responsible for the temporary storage and disposal of all liquid waste. Testing of waste shall be conducted by the Environmental Monitoring Firm under separate contract with the Owner.
  - 3) The contractor shall submit to the owner proof of proper disposal consisting of, waste hauler license and permit, trailer numbers for all vehicles and trailers used for transport, signed waste manifest and bills of lading for all shipments and from approved and licensed TSD facility. Proof of proper disposal must be submitted on an ongoing basis, within 20 days if disposal site is located within NYS, 45 days if outside NYS, and prior to or at the same time as applications for payment. The contractor will not be paid until proof of proper disposal is submitted.
- B. Hazardous Wastes/Lead Waste - Solids:
  - 1) The contractor shall supply a suitable container(s) for the storage of lead waste.
  - 2) The contractor shall be responsible for lining waste containers with two layers of 6-mil polyethylene sheeting. The contractor will keep the waste containers locked and secured at all times. The contractor shall be responsible for packaging and labeling of all lead waste.
  - 3) The Environmental Monitoring Firm hired by the Owner shall test all waste by TCLP for waste stream classification, and shall advise Owner and Contractor of TCLP results. All hazardous waste shall be disposed of at the contractor's expense, and disposal shall be as required by federal, state and local laws and/or regs as characterized by the TCLP analysis.
  - 4) The contractor shall submit to the owner proof of proper disposal consisting of, waste hauler license and permit, trailer numbers for all vehicles and trailers used for transport, signed waste manifest and bills of lading for all shipments from approved and licensed TSD facility. Proof of proper disposal must be submitted on an ongoing basis, within 20 days if disposal site is located within NYS, 45 days if outside NYS, and prior to or at the same time as applications for payment. The contractor will not be paid until proof of proper disposal is submitted.
- C. Hazardous / Regulated Wastes - Other:
  - 1) The Contractor shall place caustic paste residues in drums made out of materials that cannot be dissolved or corroded by chemicals. Caustic, acid and organic wastes must be segregated from each other and cannot be stored in same containers.
- D. Waste Containers: Contractor shall comply with EPA and DOT regulations for containers. Contractor shall contact State/local authorities to determine their criteria for containers with such information presented to the Owner. The more stringent regulations shall apply.

- E. Under no circumstances shall disposal trailer trucks and or containers be used for back hauling of any material after hazardous waste disposal.

### 3.09 - CONTAINER LABELING REQUIREMENTS:

- A. These requirements shall be enforced whenever hazardous materials or hazardous wastes shall be transported from or to the job site.
- B. Hazardous Wastes:
  - 1) Closure Date: All containers shall be marked within 48 hours of being filled and sealed.
  - 2) Labels: Such labels shall be either stenciled/painted on container or on preprinted "bumper sticker" materials. Date may be filled in neatly by hand with either weather/wear resistant paint stick or other indelible marker.
  - 3) Shipping Address: All containers shall be marked with the proper shipping address of the consignee and the shipper's address.
  - 4) DOT Classification: Where required by Federal regulations, DOT, containers shall carry a proper DOT classification diamond (4" X 4") and proper UN#. Where required by law, any trucks used to transport materials shall be properly placarded as to hazard classification.

### 3.10 - LEAD REMOVAL PHASING:

- A. Contractor shall coordinate removal of all Lead Based Painted Surfaces with the Architect's and Owner's Representatives to facilitate phasing of work.

END OF SECTION 028333

## SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

##### B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with **ACI 301 (ACI 301M)**.
  - a. Location of construction joints is subject to approval of the Architect.

#### 1.3 INFORMATIONAL SUBMITTALS

##### A. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 FORM-FACING MATERIALS

##### A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

- a. Plywood, metal, or other approved panel materials.
  - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - 1) APA HDO (high-density overlay).
    - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
    - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
    - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
- 1. Provide lumber dressed on at least two edges and one side for tight fit.

## 2.2 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than **0.022-inch- (0.55-mm-)** thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than **0.034 inch (0.85 mm)** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch (19 by 19 mm)**, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than **1 inch (25 mm)** to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than **1 inch (25 mm)** in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301** (**ACI 301M**).
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of **ACI 117** (**ACI 117M**) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes and Section 033300 "Architectural Concrete."
- C. Limit concrete surface irregularities as follows:
  - 1. Surface Finish-1.0: ACI 117 Class D, **1 inch** (**25 mm**).
  - 2. Surface Finish-2.0: ACI 117 Class B, **1/4 inch** (**6 mm**).
  - 3. Surface Finish-3.0: ACI 117 Class A, **1/8 inch** (**3.0 mm**).
- D. Construct forms tight enough to prevent loss of concrete mortar.
  - 1. Minimize joints.
  - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
  - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
  - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
  - 1. Provide and secure units to support screed strips.
  - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
  - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
  - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches** (**305 mm**).
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.



1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

### 3.3 SHORING AND RESHORING INSTALLATION

A. Comply with **ACI 318 (ACI 318M)** and **ACI 301 (ACI 301M)** for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

## SECTION 032000 - CONCRETE REINFORCING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

- a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- D. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- E. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, plain steel.

## 2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
    - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
    - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
    - e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.
  - 1. Finish: Plain

## 2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.

2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

### 3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
  2. Stagger splices in accordance with ACI 318 (ACI 318M).
- G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (305 mm).
  2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
  3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  4. Lace overlaps with wire.

### 3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement.
  2. Continue reinforcement across construction joints unless otherwise indicated.
  3. Do not continue reinforcement through sides of strip placements of floors and slabs.

### 3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117 (ACI 117M).

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Steel-reinforcement placement.

END OF SECTION 032000

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

##### B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

#### 1.2 DEFINITIONS

- ##### A. Cementitious Materials:
- Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.

- ##### B. Water/Cement Ratio (w/cm):
- The ratio by weight of water to cementitious materials.

#### 1.3 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference:
- Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- ##### A. Product Data:
- For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:

- a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

6. Vapor retarders.
7. Liquid floor treatments.
8. Curing materials.
9. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

## 1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:



1. Portland cement.
  2. Fly ash.
  3. Slag cement.
  4. Aggregates.
  5. Admixtures:
- C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
- D. Preconstruction Test Reports: For each mix design.
- E. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
1. Include the following information in each test report:
    - a. Admixture dosage rates.
    - b. Slump.
    - c. Air content.
    - d. Seven-day compressive strength.
    - e. 28-day compressive strength.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

#### 1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

### 2.2 CONCRETE MATERIALS

#### A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II, gray.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Air-Entraining Admixture: ASTM C260/C260M.

- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

## 2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

## 2.4 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

## 2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
  - 1. Color:
    - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
    - b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
    - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- C. Curing Paper: Eight-foot- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- D. Water: Potable or complying with ASTM C1602/C1602M.

## 2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Floor Slab Protective Covering: Eight-foot- (2438-mm-) wide cellulose fabric.

## 2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Other Pozzolans: 25 percent by mass.

2. Slag Cement: 50 percent by mass.
  3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
  4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

## 2.8 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, foundation walls and piers.
1. Exposure Class: ACI 318 (ACI 318M) F2, S0, W0, C1.
  2. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
  3. Maximum w/cm: 0.45.
  4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm) plus or minus 1 inch (25 mm) before adding high-range water-reducing admixture or plasticizing admixture at Project site.
  5. Air Content:
    - a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.
  6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- B. Class B: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
  2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
  3. Maximum w/cm: 0.45.
  4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm) plus or minus 1 inch (25 mm) before adding high-range water-reducing admixture or plasticizing admixture.
    - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
  5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- C. Class C: Normal-weight concrete used for exterior slabs, stairs and ramps.

1. Exposure Class: ACI 318 (ACI 318M) F3, S0, W1, C2.
2. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
3. Maximum w/cm: 0.40.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches (75 mm) plus or minus 1 inch (25 mm) before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
  - a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Class D: Normal-weight concrete used for interior suspended slabs.

1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Slump Limit: 8 inches (200 mm), plus or minus 1 inch (25 mm) for concrete with verified slump of 3 inches ((75 mm),) plus or minus 1 inch ((25 mm),) before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
  - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
7. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions.

E. Class F: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: ACI 318 (ACI 318M) F0, S0, W0, C0.
2. Minimum Compressive Strength: 4000 psi (20.7 MPa) at 28 days.
3. Maximum w/cm: 0.45.
4. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
5. Maximum Size Aggregate: 1/2 inch (13 mm).
6. Slump Limit: 3 inches (75 mm), plus 1 inch (25 mm) or minus 2 inches (50 mm).
7. Air Content: 0 percent, plus or minus 0.5 percent at point of delivery.
8. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
9. Retarding Admixture: Not allowed.
10. Accelerating Admixture: Not allowed.

## 2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
  - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
  - 3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
  - 4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
  - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  - 7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

### 3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  - 2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
    - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
  - 1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  - 2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

### 3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.
  3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
  2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  3. Maintain reinforcement in position on chairs during concrete placement.
  4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  5. Level concrete, cut high areas, and fill low areas.
  6. Slope surfaces uniformly to drains where required.



7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

### 3.5 FINISHING FORMED SURFACES

#### A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
  - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
  - b. Remove projections larger than 1 inch (25 mm).
  - c. Tie holes do not require patching.
  - d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
  - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
  - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
  - b. Remove projections larger than 1/4 inch (6 mm).
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
  - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

#### B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.6 FINISHING FLOORS AND SLABS

#### A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

#### B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.

3. Apply scratch finish to surfaces to receive concrete floor toppings] [to receive mortar setting beds for bonded cementitious floor finishes] <Insert locations>.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

### 3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches (100 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
  - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - b. Cast anchor-bolt insert into bases.
  - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

### 3.8 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
  2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
  3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
  1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  3. If forms remain during curing period, moist cure after loosening forms.
  4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

- 1) Recoat areas subject to heavy rainfall within three hours after initial application.
- 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
  - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
    - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - a) Lap edges and ends of absorptive cover not less than 12-inches (300-mm).
      - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
    - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
      - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - b) Cure for not less than seven days.
    - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
      - a) Water.
      - b) Continuous water-fog spray.

### 3.9 TOLERANCES

- A. Conform to ACI 117 (ACI 117M).

### 3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
    - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
      - 1) Project name.
      - 2) Name of testing agency.
      - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
      - 4) Name of concrete manufacturer.
      - 5) Date and time of inspection, sampling, and field testing.
      - 6) Date and time of concrete placement.
      - 7) Location in Work of concrete represented by samples.
      - 8) Date and time sample was obtained.
      - 9) Truck and batch ticket numbers.
      - 10) Design compressive strength at 28 days.
      - 11) Concrete mixture designation, proportions, and materials.
      - 12) Field test results.
      - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
      - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
1. Headed bolts and studs.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.
  5. Verification of concrete strength before removal of shores and forms from beams and slabs.
  6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

- a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
  - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
  - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
  - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
  - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
  - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M:
  - a. Cast and laboratory cure two sets of two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
  - b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
  - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
  - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
  - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
  11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  12. Additional Tests:
    - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
      - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.
  13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 72 hours of completion of floor finishing and promptly report test results to Architect.

### 3.11 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 033000

## SECTION 040120.63 - BRICK MASONRY REPAIR

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Repairing brick masonry, including replacing units.
2. Removing abandoned anchors.

#### 1.2 SEQUENCING AND SCHEDULING

A. Take delivery of and store at Project site enough quantity to complete Project.

B. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:

1. Remove plant growth.
2. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
3. Clean masonry.
4. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
5. Repair masonry, including replacing existing masonry with new masonry materials.
6. Rake out mortar from joints to be repointed.
7. Point mortar and sealant joints.
8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

C. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in mortar joints according to Section 040120.64 "Brick Masonry Repointing."

#### 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.
2. Include recommendations for product application and use. Include test data substantiating that products comply with requirements.

B. Samples for Initial Selection: For the following:

1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.



- a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
  - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
- C. Samples for Verification: For the following:
  1. Each type of brick unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
  2. Accessories: Each type of accessory and miscellaneous support.

#### 1.4 QUALITY ASSURANCE

- A. Refer to National Park Service Preservation Briefs #1 and 2 as standards for masonry cleaning and repairs.
- B. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.
  1. Field Supervision: Brick masonry repair specialist firm shall maintain experienced full-time supervisors on Project site during times that brick masonry repair work is in progress.
  2. Brick Masonry Repair Worker Qualifications: When masonry units are being patched, assign at least one worker per crew who is trained and certified by manufacturer of patching compound to apply its products.
- C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry units to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.
- B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- F. Handle masonry units to prevent overstressing, chipping, defacement, and other damage.

## 1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed according to product manufacturers' written instructions and specified requirements.
- B. Temperature Limits, General: Repair masonry units only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.
- D. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repairing brick masonry (brick, cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

### 2.2 MASONRY MATERIALS

- A. Face Brick: As required to complete brick masonry repair work.
  - 1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork and with physical properties within 10 percent of those determined from preconstruction testing of selected existing units.
    - a. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
  - 2. Special Shapes:

- a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
  - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
  - c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.
- 3. Tolerances as Fabricated: According to tolerance requirements in ASTM C 216, Type FBS.
- B. Building Brick: ASTM C 62, of same vertical dimension as face brick, for masonry work concealed from view.
  - 1. Grade SW or MW for concealed backup.

## 2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, white where required for color matching of mortar.
  - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Sand: ASTM C 144.
  - 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
  - 2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- D. Water: Potable.

## 2.4 MANUFACTURED REPAIR MATERIALS

- A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cathedral Stone Products, Inc.
    - b. Conproco Corporation.
    - c. Edison Coatings, Inc.
    - d. Architect approved equal
  - 2. Use formulation that is vapor and water permeable (equal to or more than the masonry unit), exhibits low shrinkage, has lower modulus of elasticity than masonry units being repaired, and develops high bond strength to all types of masonry.

3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
4. Formulate patching compound in colors and textures to match each masonry unit being patched. Provide no fewer than three colors to enable matching of the color, texture, and variation of each unit.

## 2.5 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of masonry units, less the required depth of pointing materials unless removed before pointing.
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
  1. Surface Preparation: Use coating requiring no better than SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning" surface preparation according to manufacturer's literature or certified statement.
  2. VOC Limit: Use coating with a VOC content of 400 g/L or less.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
  1. Previous effectiveness in performing the work involved.
  2. Minimal possibility of damaging exposed surfaces.
  3. Consistency of each application.
  4. Uniformity of the resulting overall appearance.
  5. Do not use products or tools that could leave residue on surfaces.

## 2.6 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
  1. Rebuilding (Setting) Mortar by Volume: ASTM C 270, Proportion Specification, 1 part Portland cement, 1 part lime, and 6 parts sand.

2. Rebuilding (Setting) Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime.
3. Rebuilding (Setting) Mortar by Property: ASTM C 270, Property Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
  1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
  2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
  3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repair. Reinstall when repairs are complete.
  1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

### 3.3 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items no longer in use unless indicated to remain.
  1. Remove items carefully to avoid spalling or cracking masonry.
  2. Notify Architect before proceeding if an item cannot be removed without damaging surrounding masonry. Do the following where directed:
    - a. Cut or grind off item approximately 3/4 inch beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
    - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
  3. Patch hole where each item was removed unless directed to remove and replace masonry unit.

### 3.4 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
  - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition. Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.
- D. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
  - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
  - 2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
  - 3. Store brick for reuse. Store off ground, on skids, and protected from weather.
  - 4. Deliver cleaned brick not required for reuse to Owner unless otherwise indicated.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, or with new brick matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
  - 1. Maintain joint width for replacement units to match existing joints.
  - 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C 67 initial rates of absorption (suction) of more than 30 g/30 sq. in. per min. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
  - 1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
  - 2. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.

- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
  - 1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

### 3.5 MASONRY UNIT PATCHING

- A. Patch the following masonry units unless another type of repair or replacement is indicated:
  - 1. Units indicated to be patched.
  - 2. Units with holes.
  - 3. Units with chipped edges or corners. Patch chipped edges or corners measuring more than 3/4 inch in least dimension.
  - 4. Units with small areas of deep deterioration. Patch deep deteriorations measuring more than 3/4 inch in least dimension and more than 1/4 inch deep.
- B. Remove and replace existing patches unless otherwise indicated or approved by Architect.
- C. Patching Bricks:
  - 1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least 1/4 inch thick, but not less than recommended in writing by patching compound manufacturer.
  - 2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of masonry unit.
  - 3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
  - 4. Rinse surface to be patched and leave damp, but without standing water.
  - 5. Brush-coat surfaces with slurry coat of patching compound according to manufacturer's written instructions.
  - 6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than 1/4 inch or more than 2 inches thick. Roughen surface of each layer to provide a key for next layer.
  - 7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of masonry unit. Shape and finish surface before or after curing, as determined by testing, to best match existing masonry unit.
  - 8. Keep each layer damp for 72 hours or until patching compound has set.
  - 9. Remove and replace patches with hairline cracks or that show separation from brick at edges, and those that do not match adjoining brick in color or texture.

### 3.6 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
  - 1. Do not use metal scrapers or brushes.

2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

### 3.7 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- B. Notify Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

### 3.8 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
- B. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

END OF SECTION 040120.63



## SECTION 040120.64 - BRICK MASONRY REPOINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Repointing joints with mortar.
2. Repointing joints with sealant.

#### 1.2 SEQUENCING AND SCHEDULING

A. Work Sequence: Perform brick masonry repointing work in the following sequence, which includes work specified in this and other Sections:

1. Remove plant growth.
2. Inspect masonry for open mortar joints and permanently or temporarily point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
3. Clean masonry.
4. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
5. Repair masonry, including replacing existing masonry with new masonry materials.
6. Rake out mortar from joints to be repointed.
7. Point mortar and sealant joints.
8. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.

B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to Section 040120.63 "Brick Masonry Repair." Patch holes in mortar joints according to "Repointing Masonry" Article.

#### 1.3 ACTION SUBMITTALS

A. Samples for Initial Selection: For the following:

1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/2 inch wide, set in aluminum or plastic channels.
  - a. Have each set contain a close color range of at least three Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
  - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.

B. Samples for Verification: For the following:

1. Sealant materials.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For brick masonry repointing specialist including field supervisors and workers and testing service.

#### 1.5 QUALITY ASSURANCE

- A. Refer to National Park Service Preservation Briefs #1 and 2 as standards for masonry cleaning and repairs.
- B. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry repointing firm to perform work of this Section. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.
  1. Field Supervision: Brick masonry repointing specialist firms shall maintain experienced full-time supervisors on Project site during times that brick masonry repointing work is in progress.
- C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store sand where grading and other required characteristics can be maintained and contamination avoided.

#### 1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed according to product manufacturers' written instructions and specified requirements.

- B. Temperature Limits, General: Repoint mortar joints only when air temperature is between 40 and 90 deg F and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F and above unless otherwise indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of material for repointing brick masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

### 2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II, white where required for color matching of mortar.
  - 1. Provide cement containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Sand: ASTM C 144.
  - 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
  - 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- D. Water: Potable.

### 2.3 ACCESSORY MATERIALS

- A. Sealant Materials:
  - 1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics indicated below and according to applicable requirements in Section 079200 "Joint Sealants."
    - a. Type: Single-component, nonsag urethane sealant.
  - 2. Colors: Provide colors of exposed sealants to match colors of mortar adjoining installed sealant unless otherwise indicated.

3. Ground-Mortar Aggregate: Custom crushed and ground pointing mortar sand or existing mortar retrieved from joints. Grind to a particle size that matches the adjacent mortar aggregate and color. Remove all fines passing the No. 100 sieve.
- B. Joint-Sealant Backing:
1. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or Type B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
  2. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended in writing by sealant manufacturer for preventing sealant from adhering to rigid, inflexible, joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- C. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing the work involved.
  2. Minimal possibility of damaging exposed surfaces.
  3. Consistency of each application.
  4. Uniformity of the resulting overall appearance.
  5. Do not use products or tools that could leave residue on surfaces.

## 2.4 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's approval.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
1. Pointing Mortar by Volume: ASTM C 270, Proportion Specification, 1 part Portland cement, 1 part lime, and 6 parts sand.

2. Pointing Mortar by Type: ASTM C 270, Proportion Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime.
3. Pointing Mortar by Property: ASTM C 270, Property Specification, Type N unless otherwise indicated; with cementitious material limited to Portland cement and lime.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
  1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
  2. Keep wall area wet below pointing work to discourage mortar from adhering.
  3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove gutters and downspouts and associated hardware adjacent to masonry and store during masonry repointing. Reinstall when repointing is complete.
  1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 MASONRY REPOINTING, GENERAL

- A. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from 20 feet away by Architect.

### 3.3 REPOINTING MASONRY

- A. Rake out and repoint joints to the following extent:
  1. All joints in areas indicated.
  2. Joints indicated as sealant-filled joints.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, according to procedures demonstrated in approved mockup:
  1. Remove mortar from joints to depth of 2-1/2 times joint width, but not less than 3/4 inch or not less than that required to expose sound, unweathered mortar. Do not remove unsound mortar more than 2 inches deep; consult Architect for direction.
  2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
  3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Pointing with Mortar:

1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Pointing with Sealant: Comply with Section 079200 "Joint Sealants." and as follows:

1. After raking out, keep joints dry and free of mortar and debris.
2. Clean and prepare joint surfaces. Prime joint surfaces unless sealant manufacturer recommends against priming. Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant.
  - a. Install cylindrical sealant backing beneath the sealant. Where space is insufficient for cylindrical sealant backing, install bond-breaker tape.
  - b. Install sealant using only proven installation techniques that ensure that sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
  - c. Install sealant as recommended in writing by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
    - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
  - d. Tool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant from surfaces adjacent to joint.
  - e. Sanded Joints: Immediately after first tooling, apply ground-mortar aggregate to sealant, gently pushing aggregate into the surface of sealant. Lightly retool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant and aggregate from surfaces adjacent to joint.
  - f. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and

spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.

- G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

### 3.4 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
  - 1. Do not use metal scrapers or brushes.
  - 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

### 3.5 FIELD QUALITY CONTROL

- A. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- B. Notify Architect's Project representatives in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until Architect's Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

END OF SECTION 040120.64

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
- 2. Shrinkage-resistant grout.

- B. Related Requirements:

- 1. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting requirements.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

#### 1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 ACTION SUBMITTALS

- A. Product Data:



1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Etching cleaner.
8. Galvanized repair paint.
9. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Source quality-control reports.
- F. Field quality-control reports.

## 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that has at least 10 years of similar project experience.
- B. Installer Qualifications: A qualified Installer that has at least 5 years of similar project experience.
- C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303.
- B. Connection Design Information:
  - 1. Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
    - a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
    - b. Connections shall be selected to support one-half of maximum total uniform load shown in table 3-6.

### 2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M.
- D. Corrosion-Resisting (Weathering) Structural-Steel Shapes, Plates, and Bars: ASTM A588/A588M, 50 ksi (345 MPa).

- E. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.
- F. Corrosion-Resisting (Weathering), Cold-Formed Hollow Structural Sections: ASTM A847/A847M structural tubing.
- G. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
  - 1. Weight Class: As indicated.
  - 2. Finish: Black except where indicated to be galvanized.
- H. Welding Electrodes: Comply with AWS requirements.

## 2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip or mechanically deposited zinc coating.
  - 2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  - 1. Finish: Plain.

## 2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.

1. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A36/A36M carbon steel.
3. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
4. Finish: Plain.

B. Threaded Rods: ASTM A36/A36M.

1. Nuts: ASTM A63 (ASTM A563M) heavy-hex carbon steel.
2. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
3. Finish: Plain.

## 2.5 PRIMER

A. Steel Primer:

1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#26.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

## 2.6 SHRINKAGE-RESISTANT GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.7 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 2.
- F. Welded-Steel Door Frames: Build up welded-steel door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated on Drawings.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.8 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

## 2.10 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  2. Surfaces to be field welded.
  3. Surfaces of high-strength bolted, slip-critical connections.
  4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  5. Galvanized surfaces.
  6. Corrosion-resisting (weathering) steel surfaces.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 2.
  2. SSPC-SP 3.
  3. SSPC-SP 7 (WAB)/NACE WAB-4.
  4. SSPC-SP 14 (WAB)/NACE WAB-8.
  5. SSPC-SP 11.
  6. SSPC-SP 6 (WAB)/NACE WAB-3.
  7. SSPC-SP 10 (WAB)/NACE WAB-2.
  8. SSPC-SP 5 (WAB)/NACE WAB-1.
  9. SSPC-SP 8.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## 2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E165/E165M.
    - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

- c. Ultrasonic Inspection: ASTM E164.
  - d. Radiographic Inspection: ASTM E94/E94M.
4. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
  1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### 3.5 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with ANSI/AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

### 3.6 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."



- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

### 3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
  - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

## SECTION 055213 - PIPE AND TUBE RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Stainless steel railings and posts.

#### 1.2 COORDINATION

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Fasteners.
  - 3. Post-installed anchors.
  - 4. Handrail brackets.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required.
  - 1. Sections of posts, including finish.
  - 2. Fittings and brackets.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage] and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

### 2.2 STAINLESS STEEL RAILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Stainless Fabricators, Inc
  - 2. Tubular Specialties Manufacturing, Inc.
  - 3. Tuttle, a Dant Clayton Division
  - 4. Wagner Companies (The); R&B Wagner, Inc.
  - 5. Architect approved equal
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Tubing: ASTM A554, Grade MT 316L

### 2.3 FASTENERS

- A. Fastener Materials:
  - 1. Stainless Steel Railing Components: Type 316 stainless steel fasteners.
  - 2. Finish exposed fasteners to match appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
  - 2. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  - 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.4 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
  - 1. Clearly mark units for reassembly and coordinated installation.
  - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- F. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint
- H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- I. Form changes in direction as follows:
  - 1. As detailed on drawings.
- J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain

cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
  - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
  - 2. Coordinate anchorage devices with supporting structure.
- M. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

## 2.5 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
- C. Stainless Steel Pipe and Tubing Finishes:
  - 1. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
- D. Stainless Steel Sheet and Plate Finishes:
  - 1. Directional Satin Finish: ASTM A480/A480, No. 4.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
  - 1. Fit exposed connections together to form tight, hairline joints.
  - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
  - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
  - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

### 3.3 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.

### 3.4 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with [sleeves concealed within][flanges connected to][brackets on underside of rails connected to] railing ends and anchored to wall construction with anchors and bolts.
- B. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt
  - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For hollow masonry anchorage, use toggle bolts.
- D. Install railing gates level, plumb, and secure for full opening without interference.
  - 1. Attach hardware using tamper-resistant or concealed means.

2. Adjust hardware for smooth operation.

### 3.5 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Rooftop equipment bases and support curbs.
  - 2. Wood blocking, cants, and nailers.
  - 3. Wood furring.
  - 4. Wood sleepers.
  - 5. Plywood backing panels.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
  - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

#### 1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.



## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

### 2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Treatment shall not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Concealed blocking.
  - 2. Framing for non-load-bearing partitions.
  - 3. Framing for non-load-bearing exterior walls.
  - 4. Roof construction.
  - 5. Plywood backing panels.

## 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  - 2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  - 3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 4. Eastern softwoods; No. 2 Common grade; NeLMA.
  - 5. Northern species; No. 2 Common grade; NLGA.
  - 6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

## 2.5 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

## 2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- B. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.

- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - 2. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

### 3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

## SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. High Pressure Laminate (HPL) - faced architectural cabinets w/ PVC Edge Banding.
2. High Pressure Laminate (HPL) - faced architectural cubbies w/ PVC Edge Banding.
3. Thermally Fused Melamine Laminate – interior cabinet.
4. Accessories and cabinet hardware.
5. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

#### 1.2 COORDINATION

- ##### A.
- Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

#### 1.3 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by a treating plant that treated materials comply with requirements.

##### B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

##### C. Samples for Initial Selection: For each type of exposed finish.

##### D. Samples for Verification: For the following:

1. High Pressure plastic Laminates (HPL): **No physical samples required.** Submit (1) physical color chart ONLY. Architect has chip samples in-house.
2. Thermally Fused Melamine Laminates (TFL): **No physical samples required.** Submit (1) physical color chart ONLY. Architect has chip samples in-house.

3. Provide one sample applied to core material with specified edge material applied to one edge.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For each type of product.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
  2. TFL panels are produced by a manufacturer with documented quality management and environmental management practices and procedures in place to ensure compliance with specified requirements.
- B. Installer Qualifications: Manufacturer of products or Licensed participant in AWI's Quality Certification Program.
- C. Fabricator Qualifications: Minimum of 5 years of documented experience in fabricating high-pressure laminate and thermally fused laminate panels similar in scope and complexity to this project.
- D. Source Limitations: Obtain each type of high-pressure decorative laminate and thermally fused laminate from a single manufacturer for the entire Project and obtain architectural cabinets from a single fabricator.
- E. **Mockups:** Before fabricating the remainder of the Work, build one complete base cabinet unit with countertop, edge banding, and cabinet hardware installed, for verification of construction, finish, and hardware. Obtain Architect's approval of the mockup before fabricating the balance of the Work.

## 1.7 PRE-INSTALLATION

- A. Preinstallation Conference: Conduct conference at Project site to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section. Construction Manager, General Contractor / Millwork Installers, Architect and if necessary, Owner's representative is to be present.
  - 1. Review methods and procedures related to architectural cabinet fabrication and installation, including but not limited to the following:
    - a. **Lakeshore H.S. – Media Center:** coordination regarding the details of the custom millwork units, cubbies, etc.
    - b. Review and finalize the construction schedule, personnel, equipment, and facilities needed to make progress and avoid delays.
    - c. Materials, material application, and sequencing.
    - d. Quality-control program.
    - e. Coordination with building occupants.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in the "Field Conditions" Article.
- B. Store both HPL and TFL Panel materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturers. Store materials flat on pallets or similar rack-type storage to avoid damage. The moisture content of TFL panels does not exceed 6 to 8 percent.

## 1.9 FIELD CONDITIONS

- A. Environmental Requirements: Ensure appropriate acclimatization between plastic laminate and substrate prior to fabrication. Condition plastic laminate and substrate surfaces in the same environment for 48 hours prior to fabrication. Condition at approximately 75 degrees F and 45 percent to 55 percent relative humidity.
  - 1. Adhesive: For best results, apply adhesives at temperatures at or above 65 degrees F.
- B. Environmental Limitations: Do not deliver or install cabinets and countertops until the building is enclosed, wet-work is complete, and the HVAC system operates and maintains temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets and countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate

measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets and paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets and countertops are indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 HIGH-PRESSURE LAMINATE MATERIALS

- A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC ; High Pressure Laminate and/or a comparable product by one of the following:
    - a. Formica Corporation.
    - b. Architect approved equal.
- B. Enhanced Laminate Performance:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC ; High Pressure Laminate with AEON Enhanced Performance Technology surface wear resistance and surface abrasion and/or a comparable product by one of the following:
    - a. Formica Corporation.
    - b. Architect approved equal.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  1. As selected by Architect from laminate manufacturer's full range inclusive of basis of design's (Wilsonart) styles and laminate for standard 38, 60 and 28 surface textures. Specialty premium surface textures, high-definition wood grains, etc. or equivalent from other manufacturers verified through sample submittals.

### 2.2 LAMINATE PROPERTIES

- A. Laminate Composition: High-Pressure Decorative Laminate surface papers impregnated with melamine resins and pressed over kraft paper core sheets with phenolic resins. Sheets then bonded together under pressures greater than 1,000 lbs. per sq. in. and high temperatures approaching 300 degrees F. Finished sheets trimmed and backs sanded to facilitate bonding to substrate.



B. Surface Burning Characteristics:

1. Test Standards: ASTM E 84, ASTM E 162, ASTM E 662, IMO FTP Code Part 2 and Part 5, and UL 723
2. Interior Finish Classification, Fire-Rated Laminate: Class A according to NFPA 101. Flame spread to less than 25 and Smoke Developed less than 450.
3. Surfaces that are Subject to Food Contact: Comply with NSF Standard 35.

2.3 HIGH PRESSURE LAMINATE - FACED ARCHITECTURAL CABINETS – **[HPL-1]**

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

1. Reveal Dimension: 1/4 inch.

E. Grain Direction for Wood Grain Plastic Laminate:

1. Vertical on doors and on drawer fronts.
2. Lengthwise on face frame members.
3. Vertical on end panels.
4. Side to side on bottoms and tops of units.
5. Vertical on knee-space panels.
6. Vertical on aprons.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade -VGS.
4. Edges: PVC tape, 1mm minimum thickness, matching adjacent laminate in color and pattern.
5. Pattern Direction: As indicated on drawings.

G. Materials for Exposed, Semi-Concealed and Concealed Cabinet and Drawer Surfaces:

1. Surfaces Other Than Drawer Bodies and the concealed interior of the cabinet boxes: High-pressure decorative laminate (HPL).
    - a. Edges of exposed Plastic-Laminate Shelves: PVC tape, 1mm minimum thickness, matching adjacent laminate in color and pattern.
  2. Semi-Concealed drawer Bodies (Sides and Backs): Solid-hardwood (maple) lumber
  3. Semi-Concealed drawer Bottoms: Hardwood plywood.
- H. Dust Panels: Provide 1/4-inch plywood or tempered hardboard dust panels above compartments and drawers, except where the drawer or compartment is located directly beneath a countertop.
- I. Concealed Backs of Doors and Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate (HPL), NEMA LD 3, Grade BKL.
- J. Drawer Front Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
  2. Edges: PVC tape, 1mm minimum thickness, matching adjacent laminate in color and pattern.
- K. Filler and Closure Panels: To match adjacent High-Pressure Decorative Laminate (HPL) finishes. Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated appliances. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.

## 2.4 THERMALLY FUSED LAMINATE – CABINET INTERIORS

- A. Thermally Fused Laminate: composed of melamine saturated decorative layers thermally fused to both core faced surfaces with heat and pressure. Stain resistant surface with wear and scratch resistance.
- B. Panel Core Material: Composite panel product composed primarily of cellulosic materials and a bonding system, substrate suitable for laminate overlays.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC ; High Pressure Laminate and/or a comparable product by one of the following:
    - a. Formica Corporation.
    - b. Uniboard.
    - c. Architect approved equal.
  2. Edge band Products: Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC ; High Pressure Laminate and/or a comparable product by one of the following:
    - a. Charter Industries.
    - b. Architect approved equal.

- 1) Composition: PVC extruded fabrication.
- 2) Width: Equal to or greater than panel thickness.
- 3) Finish: Match TFL panels.
- 4) Color: Match TFL panels.
- 5) Edge location: on all exposed and semi-exposed edges. Adjustable shelves should have edging on all 4 sides.

## 2.5 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Medium – Density Fiberboard (MDF) ANSI A208.2, Grade 130
  2. Particleboard: ANSI A208.1. Grade M-2 Exterior Glue at sink locations.
  3. **At Wet Areas** = Particleboard: ANSI A208.1
    - a. Moisture resistant at base cabinets and countertops.
    - b. Grade: M-3.
    - c. 48 lb. Density Minimum.
    - d. Screw holding face – 225 lbs. and Edge – 202 lbs.
  4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of AWI 300.
- C. KerfKore flexible architectural panels for all curved desk and shelving locations.
  1. Timberflex flexible panel made with:
    - a. Particleboard core.
    - b. RSN Tan flexible backer.
    - c. 3-Ply Italian poplar plywood face.
    - d. HPL Laminate can then be applied to the curved substrate after it is formed.
    - e. Panel Size: 48 by 96 inches nominal.
    - f. Cannot be used in wet applications.

## 2.6 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type) for office/faculty cabinets: BHMA A156.9, B01602, 170 degrees of opening, soft closing.
- C. Door / Drawer Pulls: Hollow European Cylindrical Bar Door / Drawer Pulls
  - a. Finish: Brushed Satin Nickel
  - b. Mounting: Back mounted BHMA A156.9, B02011

- c. Centers: 3 ¾" or 4" inches long
  - d. Length: 6.13"
  - e. Screw Size: 8-32
  - f. Projection: 1.38"
- D. Catches: Magnetic catches, BHMA A156.9, B03141.
  - 1. Basis of Design Product: KV 918 ALUM Heavy-Duty Aluminum Magnetic Catch, 2-1/16 inches by 1 inch, pull strength of approximately 7 pounds, aluminum finish. Screw-mounted catch and strike plate have slotted holes for adjustability.
  - 2. Doors up to 36 inches high: one catch each.
  - 3. Doors 36 inches high and over: two catches, located top and bottom.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112. Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, for nominal 1 inch spacing.
  - 1. Basis of Design Product: KV Series 82 Heavy-Duty Standards and 182 Series Heavy-Duty Brackets
    - a. Powder-coat finish
    - b. 16-gauge steel brackets, 14-gauge steel standards
    - c. Adjustable on 1-inch centers.
    - d. Height: As indicated in Drawings
- F. Drawer Slides: BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted and extended under bottom edge of drawer. Full extension type; zinc-plated steel with polymer rollers. Self-closing/stay-closed type.
  - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
  - 4. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
  - 5. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
  - 6. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
  - 7. For computer keyboard shelves, provide Grade 1.
- G. Door Locks - Doors: BHMA A156.11, E07121. Keyed cylinder, two keys per master keyed. **NOTE:** Door locks are required by the Owner on all single cabinet doors and (1) lock per pair of cabinet doors, and wardrobes.
 

**NOTE:** Door locks are also required on all file drawers, (1) lock per drawer.
- H. Drawer Locks - Drawers: BHMA A156.11, E07041. Keyed cylinder, two keys per lock, master keyed. **NOTE:** Drawer locks are required by the Owner on all single drawers and (1) lock per pair of double drawers, and file cabinets.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.
  - 1. Color: Clear
- J. Wire-Management Grommets: Round Grommets with Brush, metal with matching caps and slot for wire passage.

1. **Basis-of-Design Product:** Subject to compliance with requirements, provide **Richelieu Metal Grommet #16602190.**
  - a. Outside Diameter: 2 3/8 inches.
  - b. Color: As selected by Architect.
  - c. Spacing: As indicated on Drawings.
  - d. Locations: Provide where indicated on drawings. Field verify final grommet locations in field with Owner/Architect.
  
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated. Color to be selected by Architect from manufacturer's full range.
  
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
  
- M. Shelf Support Brackets: To be used at wall mounted shelving locations and shallow countertops (18" and less).
  1. Concealed bracket type
  2. Color: As selected by architect from manufacturer's full range.
  3. Attach per manufacturer's installation instructions. Shelves should be secured with silicone adhesive to avoid tipping.
  
- N. Surface- Mount Counter Support Brackets:
  1. Basis of Design Product: 1" Concealed Flat Bracket by A&M Hardware, Inc.
    - a. Provide Concealed Flat Bracket sized for 20-inch-deep counters and up.
    - b. Provide Concealed Flat Bracket sized for 10-inch counters/shelving and up, with In-side Wall Brackets.
    - c. Color: White
    - d. Weight Capacity: 1100 lbs. to 4900 lbs. per pair.
    - e. Spacing: 32 inches on center maximum.
  
- O. Nails and Supports (at all enclosed cabinets):
  1. **Basis of Design Product:** 244-81N nails and #256 Steel Shelving Supports (for use with #255 standards) by Knape & Vogt Manuf. Co.
    - a. Color: As selected by Architect from manufacturer's full range of selections to match adjacent pilaster standards.
  2. 32 mm x 5mm line boring with steel shelf pins.
  
- P. File Bar Rail: Front to back filing rails for hanging file folders.
  1. Material: 16 GA aluminum 1/8-inch file bar.
  2. Provide file bars for all file cabinet drawers in the project, with a minimum of 8 locations.
  
- Q. Millwork Edge Protection Trim: Fry Reglet Millwork Corner Key
  1. 1/2" profile, MWCK50
  2. Color: Black Powder Coat
  3. Install at all vertical and horizontal exposed millwork edges on new Circulation Desk.
  
- R. Millwork Reveal Trim: Fry Reglet Millwork 1/4" Post

1. Provide in thickness required by adjacent millwork panels.
2. Color: Black Powder Coat
3. Install all vertical laminate seam locations indicated on the drawings.

S. Closet Rod

1. KV 880 Series Commercial Extra-Duty Oval Closet Rod
2. Color: Standard Brilliant Chrome finish
3. Install with all required supports and hardware

## 2.7 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Type recommended by manufacturer to suit the application.

## 2.8 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  1. Notify Architect not less than seven days in advance of completion of fabrication, to permit review of completed assemblies in the shop before shipment.
  2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to the maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burs.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through the back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- E. Field Joining: Where possible, make in the same manner as shop joining using dowels, splines, adhesives, and fasteners recommended by the manufacturer. Prepare edges to be joined in shop so project/site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
- F. Install TFL Panel components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Shim as required during installation process.
- G. Attach TFL Panel components to substrates as indicated on Drawings and approved shop drawings.

### 3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork fabrication, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
  - 1. Inspection entity shall prepare and submit the report of inspection.

### 3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets and/or all surfaces, where possible, to eliminate functional and visual defects. Where it is not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces; including HPL, TFL and edging according to manufacturer's published care and maintenance instructions. Completely remove deleterious substances from finishes surfaces.

### 3.5 PROTECTION AND MAINTENANCE MATERIALS

- A. Protect installed architectural cabinets from damage until Substantial Completion. Replace units that cannot be restored to their original condition.
- B. Maintenance Materials: Before Substantial Completion, furnish to the Owner not less than 10 square feet of each plastic laminate and 20 linear feet of each edge band used on the Project, in the colors and patterns installed.

END OF SECTION 064116



## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

#### 1.3 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.

#### 1.4 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, no-nsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Basis of Design: Dow Corning Corporation, 795
    - b. Sika Corporation Joint Sealants
    - c. Pecora Corporation

### 2.3 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Construction Foam Products; a division of Nomaco, Inc.
    - c. Architect approved equal.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
    - d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form

smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

#### A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
  - a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
  - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
  - a. Whether sealants filled joint cavities and are free of voids.
  - b. Whether sealant dimensions and configurations comply with specified requirements.
  - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

#### B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

#### 1.2 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 7. Details of accessories.
  - 8. Details of moldings, removable stops, and glazing.
  - 9. Details of conduit and preparations for power, signal, and control systems.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door; ASSA ABLOY.
  - 2. Curries Company; ASSA ABLOY.
  - 3. Steelcraft; an Allegion brand.
  - 4. Architect approved equal
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.
- C. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- D. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

### 2.2 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1..
  - 1. Physical Performance: Level C according to SDI A250.4.
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
    - d. Edge Construction: Model 1, Full Flush.
    - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
  - 3. Frames:
    - a. Materials: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch.



- b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
- c. Construction: Face welded.

## 2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Commercial Doors and Frames: NAAMM-HMMA 861. At locations indicated in the Door and Frame Schedule.
  - 1. Physical Performance: Level A according to SDI A250.4.
- C. Energy Performance: Certify and label energy performance according to NFRC as follows:
  - 1. Thermal Transmittance (U-factor): Entire door assembly including opaque fixed glazing and framing areas shall have U-factor of not more than 0.37 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
- D. Air Infiltration: Maximum rate of 0.2 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.
- E. Structural Loads:
  - 1. Wind Loads: Minimum 115 MPH
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum G60A60 coating.
    - d. Edge Construction: Continuously welded with no visible seam.
    - e. Core: Steel stiffened.
  - 3. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch, with minimum G60A60 coating.
    - b. Construction: Face welded.
  - 4. Exposed Finish: Prime.

## 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
  3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

## 2.5 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- B. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- F. Glazing: Comply with requirements in Section 088000 "Glazing."
- G. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
1. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.

2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
  3. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    - c. Compression Type: Not less than two anchors in each frame.
    - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
  6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 4. Provide loose stops and moldings on inside of hollow-metal work.
  - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
  - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 6. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  - 7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
    - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
  - 1. Section 088813 "Fire-Resistant Glazing" for glass view panels in flush wood doors.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
  - 1. Door core materials and construction.
  - 2. Door edge construction
  - 3. Door face type and characteristics.
  - 4. Door louvers.
  - 5. Door trim for openings.
  - 6. Door frame construction.
  - 7. Factory-machining criteria.
  - 8. Factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
  - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
  - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
  - 3. Details of frame for each frame type, including dimensions and profile.
  - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 5. Dimensions and locations of blocking for hardware attachment.
  - 6. Dimensions and locations of mortises and holes for hardware.
  - 7. Clearances and undercuts.
  - 8. Requirements for veneer matching.
  - 9. Doors to be factory finished and application requirements.
  - 10. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Polymer edging, in manufacturer's standard colors.
3. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

### 1.3 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

### 1.4 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
  1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
  1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.



## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of veneer.
    - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basis of Design: Masonite
  - 2. Algoma Hardwoods, Inc.
  - 3. Graham Wood Doors; an Assa Abloy Group company.
  - 4. Mohawk Doors; a Masonite company.
  - 5. Architect approved equal.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.
  - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

## 2.3 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WT's "Architectural Woodwork Standards."
  - 1. Provide labels from AWI certification program indicating that doors comply with requirements of grades specified.
  - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
  - 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  - 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  - 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 4. Pairs: Provide formed-steel edges and astragals with intumescent seals.
- D. Mineral-Core Doors:
  - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

## 2.4 FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors :
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Basis of Design: Masonite
    - b. Algoma Hardwoods, Inc.
    - c. Graham Wood Doors; an Assa Abloy Group company.
    - d. Mohawk Doors; a Masonite company.
    - e. Architect approved equal.
  - 2. Performance Grade: WDMA I.S. 1A: Heavy Duty.
  - 3. Architectural Woodwork Standards Grade: Premium

4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
  - a. Species: Select white birch or European Birch
  - b. Cut: Plain sliced (flat sliced).
  - c. Match between Veneer Leaves: Book match.
  - d. Assembly of Veneer Leaves on Door Faces: Running match.
  - e. Pair and Set Match: Provide for doors hung in same opening.
5. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
  - a. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
  - b. posed edges.
  - c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
    - 1) Finish steel edges and astragals with baked enamel same color as doors.
    - 2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
  - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
  1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  2. Finish faces, all four edges, edges of cutouts, and mortises.
  3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  1. Grade: Premium.
  2. Finish: Architectural Woodwork Standards System-5, Varnish, Conversion.
  3. Staining: As selected by Architect from manufacturer's full range.
  4. Effect: Open-grain finish.
  5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
  - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  - 3. Install fire-rated doors and frames in accordance with NFPA 80.
  - 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
  - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
  - 2. Machine doors for hardware.
  - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 4. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.

- c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
  - d. Comply with NFPA 80 for fire-rated doors.
- 5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- 6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
  - 1. Provide inspection of installed Work through AWI's Quality Certification Program, certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WT's "Architectural Woodwork Standards" for the specified grade.
  - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
  - 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

### 3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Exterior storefront framing.
  - 2. Storefront framing for punched openings.

#### 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.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Manufacturer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum 5 years of documented experience.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
    - a. Basic Wind Speed (MPH): 120
    - b. Importance Factor (I, II, III): II
    - c. Exposure Category (A, B, C, D): B
- C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
    - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
- D. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
    - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..
- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.38 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.40 as determined according to NFRC 200.
  3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.
- H. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1425, as follows:
1. Outdoor-Indoor Transmission Class: Minimum 30.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.



## 2.2 MANUFACTURERS

- A. Basis of Design for Storefront Systems: The storefront systems specified in this section are based upon Kawneer storefront systems. All storefront systems, including framing, spandrel panels, and accessories, are to be provided by (1) manufacturer. Subject to compliance with requirements, provide products by one of the following:
  - 1. Kawneer North America; an Alcoa company.
  - 2. Tubelite Inc.
  - 3. YKK AP America Inc.
  - 4. Architect approved equal
- B. Approved Manufacturer's storefront system:
  - 1. Kawneer Company Inc. Trifab 451UT Storefront System – 2" x 4 1/2" nominal dimension; Thermal, center glazed – for exterior applications.

## 2.3 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness (0.090" for entrance doors) at any location for the main frame and complying with ASTM B221: 6063-T6 alloy and temper.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service condition or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
- E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

## 2.4 STOREFRONT FRAMING SYSTEM

- A. Basis of design Product - KawneerTrifab 451UT Thermally Broken Framing System;
  - 1. 2"x 4-1/2" nominal dimensions
  - 2. Thermal Barrier:

- a. Kawneer DUAL Isolock® Thermal Break with two (2) 1/4" (6.4 mm) separations consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
  - b. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
- 3. Center Plane
- 4. Scw Spline Fabircation
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposed shall be stainless steel.
- D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

## 2.5 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- C. Glazing Sealants: Comply with Section 08 8000 "Glazing".
- D. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

## 2.6 FABRICATION

- A. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered. Make joints flush, hairline and weatherproof.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  - 4. Physical and thermal isolation of glazing from framing members.
  - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 6. Provisions for field replacement of glazing.
  - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- C. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.

- D. Entrance Door Fabrication:
1. Fabricate aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.
  2. Fabricate aluminum-framed entrance doors that are reglazable without dismantling perimeter framing.
    - a. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1 1/8" long fillet welds inside and outside all four corners. Glazing stop shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
    - b. Accurately fit and secure joints and corners. Make joints hairline in appearance.
    - c. Prepare components with internal reinforcement for door hardware.
    - d. Arrange fasteners and attachments to conceal from view.
  3. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.
  4. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
    - a. At exterior doors, provide compression weather stripping at fixed stops.
    - b. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.7 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
1. Color: As selected by Architect from full range of industry colors and color densities.

## 2.8 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### 3.3 INSTALLATION

#### A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

#### B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Set continuous sill members and flashing in full sealant bed to produce weathertight installation.

#### D. Install components plumb and true in alignment with established lines and grades.

#### E. Provide thermal isolation where components penetrate or disrupt building insulation.

#### F. Install flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

#### G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

#### H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

#### I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

#### J. Install aluminum framed storefront system and components to drain condensation and water penetrating joints to the exterior.

#### K. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/16 inch in 10 feet or every 0.06 inches every 3 feet non-cumulative, whichever is less.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/32 inch.

### 3.5 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken chipped, cracked, abraded, or damaged during construction period.
- D. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.
- E. Field Quality Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
  - 1. Water spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    - a. Perform a minimum of two tests in areas as directed by Architect.
- F. Aluminum framed entrances and storefronts will be considered if they do not pass tests and inspections.

END OF SECTION 084113

## SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Glazed aluminum curtain wall systems:
  - 1. Conventionally glazed.
- B. Related Requirements:
  - 1. Section 078400 "Firestopping" for perimeter fire-containment systems field installed with glazed aluminum curtain walls.
  - 2. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
  - 3. Section 088000 "Glazing" for curtain wall glazing.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- F. Delegated Design Submittals: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
  - 1. For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Source quality control reports.
- E. Field quality control reports.
- F. Sample Warranties: For special warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

## 1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical wall area as indicated on Drawings.
  - 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
  - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:



- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
  - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
  - c. Cracking, peeling, or chipping.
2. Warranty Period: Twenty years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system from single manufacturer; coordinate manufacturer and finish with Section 084113 storefront for visual consistency.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on the Structural Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches and to 1/240 of length of span of the framing member plus 1/4 inch for lengths of greater than 13 feet 6 inches.
  - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
  - 3. Cantilever Deflection: Limited to 2/175 of the unsupported length.

- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
  2. Maximum Water Leakage: In accordance with AAMA 501.1. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
  2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.
  2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.
- J. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
    - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.38 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
  2. Solar Heat Gain Coefficient (SHGC):
    - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined in accordance with NFRC 200.

3. Air Leakage:
  - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
4. Condensation Resistance Factor (CRF):
  - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 65 as determined in accordance with AAMA 1503.

## 2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Kawneer Company, Inc.;
  - b. Arconic Corporation;
  - c. YKK AP America Inc.;
  - d. EFCO Corporation;
  - e. Architectural Metals;
  - f. Apogee Enterprises, Inc.
  - g. Architect approved equal
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  1. Construction: Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
  4. Finish: Superior-performance organic finish, three-coat fluoropolymer complying with AAMA 2605; color and gloss as selected by Architect from manufacturer's full range, to match Section 084113 "Aluminum-Framed Entrances and Storefronts."
  5. System: Stick system.
  6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  7. Steel Reinforcement: As required by manufacturer.
- C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
  1. Include snap-on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## 2.4 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

1. Color: Black.
- C. Glazing Sealants: As recommended by manufacturer.
1. Color: Black.
- D. Weatherseal Sealants: ASTM C920, Type S, Grade NS, Class 25, Uses NT, G, A, and O; chemically curing silicone formulation compatible with system components and as recommended by manufacturer.
1. Color: As selected by Architect to match framing finish.

## 2.5 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209.
- B. Aluminum Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Aluminum Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
  2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

## 2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  2. Reinforce members as required to receive fastener threads.
  3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding

flashing compatible with adjacent materials.

- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

## 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.
  - 6. Provisions for safety railings mounted on interior face of mullions.
  - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
  - 8. Components curved to indicated radii.
- D. Fabricate components to resist water penetration as follows:
  - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
  - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory-Assembled Frame Units:
  - 1. Rigidly secure nonmovement joints.
  - 2. Seal joints watertight unless otherwise indicated.
  - 3. Install glazing to comply with requirements in Section 088000 "Glazing."
    - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
    - b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
    - c. Install weatherseal sealant to completely fill cavity, in accordance with sealant

- d. manufacturer's written instructions, to produce weatherproof joints.
  - d. Clean and protect glass as indicated in Section 088000 "Glazing."
  - e. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces in accordance with the coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range to match Section 084113 storefront; satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
  2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
  - J. Install components plumb and true in alignment with established lines and grades.

### 3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

### 3.4 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
  1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
  4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on one bay at least 30 feet, by one story.
- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
  1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
    - a. Perform a minimum of two tests in areas as directed by Architect.
    - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
    - a. Perform a minimum of two tests in areas as directed by Architect.
    - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
  3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
  4. Test a minimum of two areas on each building facade.
  5. Repair installation areas damaged by testing.
- D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 084413



## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. ther doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Cylinders specified for doors in other sections.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- D. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series.
  - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
  - 3. ANSI/UL 294 - Access Control System Units.
  - 4. UL 305 - Panic Hardware.
  - 5. ANSI/UL 437- Key Locks.

#### 1.2 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

### 1.3 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware

(including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of the hardware.
  3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

### 2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
  - a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
  - c. Four Hinges: For doors with heights 91 to 120 inches.
  - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
  - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
  - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
  - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
  - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:

- a. Hager Companies (HA) - BB Series, 5-knuckle.
- b. McKinney (MK) - TA/T4A Series, 5-knuckle.
- c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.

## 2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
  - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
  - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
  - 4. Tubular deadlocks and other auxiliary locks.
  - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  - 6. Keyway: Match Facility Restricted Keyway.
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
  - 1. Change Keys per Cylinder: Two (2)
  - 2. Master Keys (per Master Key Level/Group): Five (5).
  - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide temporary keyed construction cores.
- G. Key Registration List (Bitting List):
  - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  - 2. Provide transcript list in writing or electronic file as directed by the Owner.

## 2.4 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - ML2000 Series.
- b. Sargent Manufacturing (SA) - 8200 Series.
- c. Schlage (SC) - L9000 Series.

## 2.5 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) - CLX3300 Series.
- b. Sargent Manufacturing (SA) - 10X Line.
- c. Schlage (SC) - ND Series.

## 2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

## 2.7 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
  2. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC6000 Series.
    - b. LCN Closers (LC) - 4040 Series.
    - c. Norton Rixson (NO) - 7500 Series.

## 2.8 ARCHITECTURAL TRIM AND ACCESSORIES

### A. Door Protective Trim:

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:



- a. Stainless Steel: 300 grade, 050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:
  - a. Hager Companies (HA).
  - b. Rockwood (RO).
  - c. Trimco (TC).

## 2.9 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  - 1. Manufacturers:
    - a. Hager Companies (HA).
    - b. Rockwood (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  - 1. Manufacturers:
    - a. Norton Rixson (RF).
    - b. Rockwood (RO).
    - c. Sargent Manufacturing (SA).

## 2.10 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
  1. National Guard Products (NG).
  2. Pemko (PE).
  3. Reese Enterprises, Inc. (RE).

## 2.11 BOLLARDS AND PEDESTALS

- A. Bollards, pedestals, housings, and accessories used to contain access control devices. Listed manufacturers shall meet all functions and features as specified herein.
  1. Provide products with functions and features as follows:
    - a. Compliant with the Americans with Disabilities Act (ADA) and all local building codes and standards.
    - b. All seams and edges continuously welded and closed to prevent water intrusion.
    - c. Removable panels for access to areas that require mounting, wire pass, and otherwise inaccessible areas.
    - d. Tapered weather shroud on housings.
    - e. Removable access door gasketed using EPDM rubber seals or equivalent.
    - f. Stainless steel hinges.
    - g. Powder coat or hot dipped galvanized with stainless steel or polycarbonate finish as specified.
  2. Manufacturers:
    - a. Pedestal PRO (PP).
    - b. No Substitution.

## 2.12 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.13 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
  3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
  - 1. Quantities listed are for each pair of doors, or for each single door.
  - 2. The supplier is responsible for handing and sizing all products.
  - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
  - 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.
- B. Refer to Section 080671, Door Hardware Sets, for hardware sets.

#### **Hardware Sets**

##### **Set: 1.0**

Doors: 166B, 166C, 166D

|                           |                        |      |    |
|---------------------------|------------------------|------|----|
| 3 Hinge, Full Mortise     | TA2714 4-1/2" x 4-1/2" | US10 | MK |
| 1 Classroom Security Lock | 72 10XG38 LL           | US10 | SA |
| 2 Cylinder                | 80-036 .B135           | .606 | SC |
| 1 Surface Closer          | 7500                   | 691  | NO |
| 1 Kick Plate              | K1050 10" x 2" LDW     | US10 | RO |
| 1 Wall Stop               | 409                    | US10 | RO |
| 1 Gasketing               | S44BL                  |      | PE |

**Set: 2.0**

Doors: 166A

|                       |                        |      |    |
|-----------------------|------------------------|------|----|
| 3 Hinge, Full Mortise | TA2714 4-1/2" x 4-1/2" | US10 | MK |
| 1 Entry/Office Lock   | 72 10XG05 LL           | US10 | SA |
| 1 Cylinder            | 80-036 .B135           | .606 | SC |
| 1 Surf Overhead Stop  | 9-_36                  | 691  | RF |
| 1 Kick Plate          | K1050 10" x 2" LDW     | US10 | RO |
| 1 Gasketing           | S44BL                  |      | PE |

**Set: 3.0**

Doors: A100A

|                              |               |        |    |
|------------------------------|---------------|--------|----|
| 2 Continuous Hinge           | DFM__SLF-HD1  |        | PE |
| 1 Electrified Mullion        | EL980         | PC     | SA |
| 1 Rim Exit Device, Storeroom | 70 AD8504 862 | US10BE | SA |
| 1 Rim Exit Device, Exit Only | AD8510 EO     | US10BE | SA |
| 2 Cylinder                   | 80-036 .B135  | .606   | SC |
| 1 Cylinder                   | 70 980C2      | US10B  | SA |
| 1 Electric Strike            | 9600          | 613    | HS |
| 2 Surface Closer             | CPS7500       | 690    | NO |
| 2 Drop Plate                 | 7788          | 690    | NO |
| 1 Gasketing                  | 5110BL        |        | PE |
| 1 Sweep                      | 3452DPK       |        | PE |
| 1 Threshold                  | 253x3DFG      |        | PE |
| 1 ElectroLynx Harness        | QC-C1500      |        | MK |
| 1 Power Supply               | AQD1-1R       |        | SU |

Notes: Balance of weather strip by aluminum frame supplier. Operation description: Door normally closed and secure. Presenting a valid credential to card reader shall energize electric strike allowing door to be pulled open. Key override at all times. In the event of a power failure or fire alarm door will remain secure. Free egress at all times

**Set: 4.0**

Doors: A100B, A100C

|                              |               |        |    |
|------------------------------|---------------|--------|----|
| 2 Continuous Hinge           | DFM__SLF-HD1  |        | PE |
| 1 Electrified Mullion        | L980          | PC     | SA |
| 1 Rim Exit Device, Storeroom | 70 AD8504 862 | US10BE | SA |
| 1 Rim Exit Device, Exit Only | AD8510 EO     | US10BE | SA |
| 2 Cylinder                   | 80-036 .B135  | .606   | SC |
| 1 Cylinder                   | 70 980C2      | US10B  | SA |
| 2 Surface Closer             | CPS7500       | 690    | NO |

|              |          |     |    |
|--------------|----------|-----|----|
| 2 Drop Plate | 7788     | 690 | NO |
| 1 Gasketing  | 5110BL   |     | PE |
| 1 Sweep      | 3452DPK  |     | PE |
| 1 Threshold  | 253x3DFG |     | PE |

Notes: Balance of weather strip by aluminum frame supplier

**Set: 5.0**

Doors: A100D, A100E, A100F

|                    |              |      |    |
|--------------------|--------------|------|----|
| 2 Continuous Hinge | DFM__SLF-HD1 |      | PE |
| 2 Push Bar & Pull  | BF15747      | 10BE | RO |
| 2 Surface Closer   | CPS7500      | 690  | NO |
| 2 Drop Plate       | 7788         | 690  | NO |

Notes: Balance of weather strip by aluminum door supplier

**Set: 6.0**

Doors: 200A, 200B

|             |                              |       |    |
|-------------|------------------------------|-------|----|
| 1 Mullion   | <a href="#">L980S</a>        | PC    | SA |
| 1 Cylinder  | <a href="#">70 980C2</a>     | US26D | SA |
| 1 Cylinder  | <a href="#">80-036 .B135</a> | .626  | SC |
| 1 Threshold | <a href="#">253x4AFG</a>     |       | PE |

Re-use balance of hardware

END OF SECTION 087100

## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.
6. Glazing film

#### 1.2 COORDINATION

##### A. Coordinate glazing channel dimensions:

1. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
2. Achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

#### 1.3 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

##### B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

#### 1.4 QUALITY ASSURANCE

##### A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

##### B. Preferred Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program or is equivalently credentialled.

##### C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited in accordance with the NFRC CAP Certification Agency Program.



- D. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian Glass, LLC; SunGuard Advanced Architectural Glass. Contact: Allison Toadvine; 484-816-7657 or comparable by one of the following:

1. AGC Glass Company North America, Inc.
  2. Vitro Architectural Glass.
- B. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- C. Source Limitations for Low-E Coated Glass: Where Low-E coated glass of a primary glass manufacturer with a certified fabricator program is specified, obtain glass in fabricated units from manufacturer certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand each applicable condition including:
1. Movements in all directions, temperature-related scenarios, and other load situations including design load cases and load case combinations without failure, which includes:
    - a. Loss or glass breakage attributable to defective manufacture, fabrication, or installation.
    - b. Failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 119.
1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Basic Wind Speed: 120 mph.
    - b. Importance Factor: II.
    - c. Exposure Category: B.
  2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites ¼ inch thick.
  2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  1. NGA/GANA Publications: "Glazing Manual.
  2. FGIA/IGMA Publication for Insulating Glass: IGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

## 2.4 GLASS PRODUCTS

- A. Clear Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian Glass, LLC; Green or comparable product as listed under Manufacturers section.
- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented upon completion of installation unless advance written approval is provided by project Architect.
- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion horizontally oriented upon completion of installation unless advance written approval is provided by project Architect.
- E. Low-E Coated Vision Glass: ASTM C1376, coated by vacuum deposition (sputter-coating) process, and complying with other requirements specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Guardian Glass, LLC; SunGuard SN 68 or comparable product as listed under Manufacturers section.
- F. Ceramic or Silicone Coated Glass: ASTM C1048, Condition B, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

## 2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
1. Sealing System: Dual seal, with manufacturer's primary and secondary sealants.
  2. Perimeter Spacer: Aluminum with bronze, color anodic finish
  3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
1. Elastomeric material with Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers:
1. Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks:
1. Elastomeric material with Shore A durometer hardness per manufacturer's written instructions.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 GLAZING FILM

- A. Privacy Glazing Film
1. Basis-of-Design: 3M CRYSTAL Frosted Crystal Glass Finishes
  2. General: Glass finishes field-applied application to glass as visual opaque film.
  3. Film: Vinyl
  4. Adhesive: Acrylic, Pressure Sensitive, Permanent
  5. Linear: Silicone-coated polyester
  6. Thickness: 4.7 mils
  7. Fire Performance: Surface burning characteristics when tested in accordance with ASTM E84, Class A

- a. Flame Spread: 25 maximum
  - b. Smoke Developed: 450 maximum
- 8. Ultraviolet Transmittance (ASTM E903): 20%
- 9. Visible Light Transmittance (ASTM E903, ASTM E308): 72%
- 10. Visible Light Reflectance (ASTM E903): 12%
- 11. Solar Heat Transmittance: 64%

## 2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.



- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.8 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Tinted Insulating Vision Glass:
  - 1. Basis-of-Design Product: Guardian Glass, LLC; SunGuard SN 68 on Green or approved equal.
  - 2. Overall Unit Thickness: 1 inch.
  - 3. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
  - 4. Outboard Lite: Guardian Green float glass.
    - a. Low-E Coating on Surface No. 2: Guardian SunGuard, SN 68.
    - b. Heat Treatment: Heat-strengthened or Fully tempered.
  - 5. Interspace: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
  - 6. Inboard Lite: Guardian clear float glass.
    - a. Heat Treatment: Heat-strengthened or Fully tempered.
  - 7. Glass Unit Performance Characteristics:
    - a. Visible Light Transmittance: 57 percent minimum.
    - b. SGHC: 0.29 maximum.
    - c. Winter Nighttime U-Factor: 0.245 maximum.
    - d. Summer Daytime U-Factor: 0.22 maximum.
- B. Glass Type : Clear insulating glass.
  - 1. Overall Unit Thickness: 1 inch.
  - 2. Minimum Thickness of Each Glass Lite: 6 mm.
  - 3. Outdoor Lite: Heat-strengthened float glass.
  - 4. Interspace Content: 1/2" Argon.
  - 5. Indoor Lite: Heat-strengthened float glass.

6. Fixed Fenestration U-Factor: 0.38 maximum.
7. Operable Fenestration U-Factor: 0.45 maximum.
8. Solar Heat Gain Coefficient: 0.40 or better.

C. Ceramic-Coated, Insulating Tinted Spandrel Glass:

1. Basis-of-Design Product: Guardian Glass, LLC; SN 68 on Green with Harmony Green Spandrel glass or approved equal.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outboard Lite: Guardian Green float glass.
  - a. Low-E Coating on Surface No. 2: Guardian SunGuard, SN 68.
  - b. Heat Treatment: Heat-strengthened or Fully tempered.
5. Interspace: Argon filled, 12 mm (1/2 inch) wide, hermetically sealed.
6. Inboard Lite: Guardian clear float glass.
  - a. Ceramic Coating on Surface No. 4: Spandrel color Harmony Green.
  - b. Heat Treatment: Fully tempered.
7. Glass Unit Performance Characteristics:
  - a. Visible Light Transmittance: 0 percent.
  - b. SGHC: 0.22 maximum.
  - c. Winter Nighttime U-Factor: 0.245 maximum.
  - d. Summer Daytime U-Factor: 0.22 maximum.

### 3.9 MONOLITHIC GLASS SCHEDULE

- A. Glass Type: Clear Fully Tempered float Glass Unit:
1. Minimum thickness of each glass lite: 1/4 inch.
  2. Safety glazing required.
  3. Color: Clear.

END OF SECTION 088000

## SECTION 088300 - MIRRORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:

1. Annealed monolithic glass mirrors.
2. Film-backed glass mirrors qualifying as safety glazing.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Binswanger Mirror; a division of Vitro America, Inc.
  - 2. Gardner Glass, Inc.
  - 3. Guardian Industries Corp.; SunGuard.
  - 4. Architect approved equal
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

### 2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

### 2.3 Annealed Monolithic Glass Mirrors: Mirror Quality, clear. Nominal Thickness: 6.0 mm.

### 2.4 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

## 2.5 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
  - 1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.04 inch.
  - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.04 inch.
  - 3. Finish: Clear bright anodized.
- B. Aluminum J-Channels and Cleat: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
- C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

## 2.6 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

### 3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

### 3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
  - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
  - 1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
  - 2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
  - 3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
  - 4. Install mastic as follows:
    - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

### 3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

## SECTION 088700 - WINDOW SECURITY GLAZING FILM

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Safety and Security Window Film:
  - 1. Clear microlayered film. (Ultra S600) (Ultra S800).

#### 1.2 REFERENCES

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.
- C. ASTM International (ASTM):
  - 1. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
  - 2. ASTM D 1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
  - 3. ASTM D 2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
  - 4. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
  - 5. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
  - 6. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
  - 7. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
  - 8. ASTM F1642 - Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings
  - 9. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings.
- D. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.
- E. GSA-TS01 - Standard Test for Glazing and Glazing Systems Subject to Airblast Loadings.
- F. NFRC 100/200 (Formerly ASTM E903) - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
- G. ISO 16933, International Standard for Glass in Building: Explosion-resistant security glazing - Test and classification for arena air-blast testing.

#### 1.3 PERFORMANCE REQUIREMENTS



- A. Safety Glazing Impact Performance:
  - 1. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
  - 2. Impact Resistance after Aging: 400 ft-lbs, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/8 inch annealed glass.
- B. Blast Hazard Mitigation Performance:
  - 1. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 63 psi\*msec, on 1/4" single pane glass and film attachment system.
  - 2. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with minimum blast load of 10 psi and 89 psi\*msec, on 1 inch (25 mm) double pane glass and film attachment system.
  - 3. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with minimum blast load of 5 psi and 28 psi\*msec, on 1/4" pane glass without film attachment system.
  - 4. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast minimum load of 10 psi and 42 psi\*msec, on 1 inch (25 mm) double pane glass without film attachment system.
- C. Impact Resistance and Pressure Cycling:
  - 1. ASTM E1996 / E1886: Large Missile "C", +/- 75 psf Design Pressure
- D. Tear Resistance:
  - 1. Minimum Graves Area Tear Strength of 1,200 lbs% as measured on coated film product, without liner, per ASTM D1004.
- E. Adhesion to Glass:
  - 1. Minimum 6 lbs/in peel strength per ASTM D3330 (Method A).
- F. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
  - 1. Flame Spread Index: no greater than 25.
  - 2. Smoke Developed Index: no greater than 55.
- G. Abrasion Resistance:
  - 1. Film shall have a surface coating that is resistant to abrasion such that less than 3 percent increase of transmitted light haze will result when tested in accordance to ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
- H. UV Light Rejection:
  - 1. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's current technical literature on each product to be used, including:
  - 1. Manufacturer's Data Sheets.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation methods.

- C. 3rd Party Test Report Submittal Requirements. Submit the following 3rd Party test reports indicating compliance with the test values listed in this section.
  - 1. Flammability Testing, ASTM E84.
  - 2. Film Properties Testing, ASTM D882.
  - 3. Abrasion Resistance Testing, ASTM D1044.
  - 4. Peel Strength Testing, ASTM D3330.
  - 5. Tear Resistance Testing, ASTM D1004.
  - 6. Puncture Strength Testing, ASTM D4830.
  - 7. Safety Glazing Impact Testing, ANSI Z97.1 and/or 16 CFR 1201.
  - 8. Impact Resistance and Pressure Cycling, ASTMs E1886 and E1996.
  - 9. Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003.
- D. Other Product Submittals:
  - 1. Manufacturer's summary of 3rd Party Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003
  - 2. 3rd Party test reports from Forced Entry Resistance evaluations.
- E. Verification Samples: For each film specified, two samples representing actual film color and pattern.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
  - 1. Provide documentation that the adhesive used on the specified films is a Pressure Sensitive Adhesive (PSA).
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
  - 1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
  - 2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
    - a. Name of building.
    - b. The name and telephone number of a management contact.
    - c. Type of glass.
    - d. Type of film and/or film attachment system.
    - e. Amount of film and/or film attachment system installed.
    - f. Date of completion.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Follow Manufacturer's instructions for storage and handling.
- B. Store products in manufacturer's unopened packaging until ready for installation.

- C. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

## 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

## 1.8 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.
- B. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design: 3M Window Film: [www.solutions.3m.com](http://www.solutions.3m.com)
- B. Armoured One, LLC: [www.armouredone.com](http://www.armouredone.com)
- C. Architect Approved Equal

### 2.2 CLEAR MICROLAYERED SAFETY AND SECURITY WINDOW FILM

- A. BASIS OF DESIGN:
- B. 3M Scotchshield Ultra S800 Safety and Security Window Film. Optically clear microlayered polyester film, nominally 8 mils (0.008 inch) thick, with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is clear and does not contain dyed polyester. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film is microlayered with both plastic and ductile polyester layers for tear resistance.
  - 1. Physical / Mechanical Performance Properties (nominal):
    - a. Film Color: Clear.
    - b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils
    - c. Tensile Strength (ASTM D882):
      - 1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
      - 2) Coated Film: 32,000 psi (MD) / 32,000 psi (TD).
    - d. Break Strength (ASTM D882):
      - 1) Base Film: 250 lb/in (MD) / 250 lb/in (TD).
      - 2) Coated Film: 245 lb/in (MD) / 265 lb/in (TD).
    - e. Percent Elongation at Break (ASTM D882):
      - 1) Base Film: 115 % (MD) / 115 % (TD).
      - 2) Coated Film: 132 % (MD) / 130 % (TD).
    - f. Yield Strength:
      - 1) Base Film: 12,000 psi (MD).

- 2) Coated Film: 15,000 psi (MD).
- g. Percent Elongation at Yield (ASTM D882):
  - 1) Base Film: 7% (MD).
  - 2) Coated Film: 9% (MD).
- h. Graves Tear Resistance (ASTM D1004):
  - 1) Maximum Force (lbs):
    - a) Base Film: 40 (MD) / 40 (TD).
    - b) Coated Film: 40 (MD) / 40 (TD).
  - 2) Maximum Extension (in):
    - a) Base Film: 0.45 (MD) / 0.65 (TD).
    - b) Coated Film: 0.50 (MD) / 0.57 (TD).
  - 3) Graves Area Tear Resistance (lbs%):
    - a) Base Film: 1,100 (MD) / 1,300 (TD).
    - b) Coated Film: 1,100 (MD) / 1,300 (TD).
- i. Puncture Propagation Tear Resistance (ASTM D2582):
  - 1) Coated Film: 9 lbf (MD) / 10 lbf (TD).
- j. Puncture Strength (ASTM D4830):
  - 1) Material Properties (as supplied).
  - 2) Coated Film: 185 lbf.
- 2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
- 3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.
- 4. Identification: Labeled as to Manufacturer as listed in this Section.
- 5. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass.
  - a. Visible Light Transmission (ASTM E 903): 87 percent.
  - b. Visible Reflection (ASTM E 903): Not more than 10 percent.
  - c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
  - d. Solar Heat Gain Coefficient (ASTM E 903): 0.79
- 6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
  - a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
  - b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
- 7. Impact Resistance and Pressure Cycling: Film shall pass impact of Large Missile "C" and withstand subsequent pressure cycling (per ASTMs E1996 and E1886) at +/- 75 psf Design Pressure with use of 3M Impact Protection Adhesive. Film applied to 1/4-inch tempered glass.
- 8. Blast Hazard Mitigation:
  - a. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 44 psi\*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Profile Attachment system
  - b. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 43 psi\*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Profile Attachment system
  - c. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 9 psi and 62 psi\*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Adhesive Attachment system
  - d. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 9 psi and 63 psi\*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Adhesive Attachment system
  - e. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 9 psi and 60 psi\*msec blast impulse, on 1 inch (25 mm) annealed double pane

- glass and 3M Impact Protection Profile Attachment system
  - f. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 10 psi and 89 psi\*msec blast impulse, on 1 inch (25 mm) annealed double pane glass and 3M Impact Protection Adhesive Attachment system
  - g. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with blast pressure of 4 psi and 28 psi\*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass, daylight applied film (no attachment)
  - h. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with blast pressure of 4 psi and 28 psi\*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass, daylight applied film (no attachment)
  - i. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast pressure of 7 psi and 42 psi\*msec blast impulse, on 1 inch (25 mm) annealed double pane glass, daylight applied film (no attachment)
- 9. Forced Entry Resistance: Product shall have been evaluated for time to resist complete body passage by a qualified 3rd Party test lab.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Film Examination:
  - 1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
    - a. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
  - 2. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
  - 3. Commencement of installation constitutes acceptance of conditions.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Adhesive or Impact Protection Profile film attachment systems.

### 3.3 INSTALLATION

- A. Film Installation, General:
  - 1. Install in accordance with manufacturer's instructions.
  - 2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
  - 3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
  - 4. Apply film to glass and lightly spray film with slip solution.

5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
8. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

#### 3.4 CLEANING AND PROTECTION

- A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION 088700

## SECTION 088813 - FIRE-RESISTANT GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

Section Includes:

Fire-protection-rated glazing.

#### 1.2 COORDINATION

Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.3 ACTION SUBMITTALS

Product Data: For each type of product.

- A. Glass Samples: For each type of glass product; 12 inches square.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

#### 1.4 WARRANTY

Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 GLASS PRODUCTS, GENERAL

Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

## 2.2 GLASS PRODUCTS

Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

- A. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
- B. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
- C. Wired Glass: Not acceptable.

## 2.3 FIRE-PROTECTION-RATED GLAZING

Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.

Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.

Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F temperature-rise limitation; and the fire-resistance rating in minutes.

- A. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; and complying with 16 CFR 1201, Category II.

Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated below or approved substitution:

- a. Schott North America, Inc.; Pyran Platinum L (Basis-of-Design).
- b. Technical Glass Products; FireLite Plus.
- c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
- d. Architect approved equal



## 2.4 GLAZING ACCESSORIES

Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

- A. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

Products: Subject to compliance with requirements, provide one of the following:

Dow Corning Corporation; 795.

- a. GE Construction Sealants; Momentive Performance Materials Inc; SilGlaze II SCS2800.
- b. Tremco Incorporated; Spectrem 2.

Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

## 2.5 GLAZING SCHEDULE

Glass Type FSGL-45: Laminated Ceramic Glazing

1. Location: All 45 minute rated interior doors, refer to door schedule in drawings
2. Basis of Design: Schott North America, Inc.; Pyran Platinum L
3. Fire Rating: min. 45 minutes
4. Overall Thickness: 3/8" (9mm)
5. Clear, fire-rated, laminated ceramic glazing

## PART 3 - EXECUTION

### 3.1 GLAZING

Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

### 3.2 CLEANING AND PROTECTION

Immediately after installation, remove nonpermanent labels and clean surfaces.

- A. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

Remove and replace glass that is damaged during construction period.

END OF SECTION 088813

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."
2. Suspension Systems: Provide manufacturers published technical literature.

B. Shop Drawings for suspension systems: Submit reflected ceiling plans drawn to scale prescribed by architect.

1. Include coordinated penetrations and ceiling mounted items.
2. Include any necessary details or drawings from the manufacturer regarding recommended installation.

C. Samples for Verification: for the following products

1. Suspension Systems: 6 in long samples of system components, including main runner, cross tees, and angle molding.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers certificates: Provide manufacturers written certification that products comply with specified requirements.

#### 1.4 QUALITY ASSURANCE

A. Source Limitations:

1. Suspension Systems: Obtain all suspension system framing components through one source from a single manufacturer

B. Coordination of work:

1. Coordinate drywall furring work with installers of related work including, but not limited to acoustical ceilings, building insulation, gypsum board, lighting fixtures, mechanical systems, and electrical systems.

2. All work above ceiling line should be completed prior to installing the drywall sheet goods. There should be no materials resting against or wrapped around the suspension system, hanger wire, or ties.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Suspension system materials to project site in original unopened packages with the manufacturers label in tack and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

### 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. ClarkDietrich Building Systems.
  2. Marino\WARE.
  3. MBA Building Supplies.
  4. Architect approved equal.
- C. Studs and Runners: ASTM C 645.
  1. Steel Studs and Tracks:
    - a. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection..

- b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  - 2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
  - 3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: to suit purpose.
  - 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Flexible gypsum board.
4. Gypsum ceiling board.
5. Cementitious backer units.
6. Joint treatment materials.
7. Laminating adhesive.
8. Sound-attenuation blankets.
9. Acoustical sealant.

#### 1.3 DELIVERY, STORAGE AND HANDLING

- ##### A.
- Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.4 FIELD CONDITIONS

- ##### A.
- Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- ##### B.
- Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- ##### C.
- Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) American Gypsum
  - 2) CertainTeed Corporation
  - 3) National Gypsum Company
  - 4) United States Gypsum Company

### 2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard, Type X: ASTM C1396/C1396M.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
- B. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
  - 1. Thickness: 1/4 inch.
  - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: Type X: ASTM C1396/C1396M.
  - 1. Thickness: 1/2 inch.
  - 2. Long Edges: Tapered.
- D. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
  - 1) Core: 5/8 inch
  - 2) Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
  - 3) Long Edges: Tapered.

- 4) Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
  1. Thickness: 5/8 inch.
  2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
  2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. L-Bead: L-shaped; exposed long flange receives joint compound.
    - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - e. Expansion (control) joint.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.
  2. Exterior Gypsum Soffit Board: Paper.
  3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound drying-type, all-purpose compound, or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

- E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

- G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with

manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: As indicated on Drawings or where rated assemblies are called for.
3. Flexible Type: Apply in double layer at curved assemblies.
4. Ceiling Type: As indicated on Drawings in ceiling locations.

- B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum

board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

### 3.4 INSTALLATION OF TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.
  3. L-Bead: Use where indicated.
  4. U-Bead: Use at exposed panel edges.
  5. Curved-Edge Cornerbead: Use at curved openings.

### 3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
  - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
4. Level 5: Where indicated on Drawings.
  - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## SECTION 093013 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Glazed ceramic tile.
  - 2. Unglazed ceramic bisque tile.
  - 3. Stone thresholds.
  - 4. Waterproofing membrane.
  - 5. Crack isolation membrane.
  - 6. Metal edge strips.

#### 1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face size: Actual tile size, excluding spacer lugs.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation conference: conducted at project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- C. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required. for ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  - 2. Full size samples of each type of trim and accessory for each color and finish.



3. Metal Edge Strips: 6-inch lengths.

D. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

#### 1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Association or a Trowel of Excellence member of the Tile Contractor's Association of America.

2. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

B. Mockups: Build mockups to verify selections made under Sample submittals and to determine aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.

2. Build mockup of each type of wall tile installation.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work in undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

- C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproofing membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Stone thresholds.
  - 2. Metal edge strips.
  - 3. Waterproof membrane.
  - 4. Crack isolation membrane.
  - 5. Cementitious backer units.

### 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.3 TILE PRODUCTS

### A. Tile type **CT-1, CT-2, CT-3**: Glazed ceramic tile.

- 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. **Basis of Design: Dal-Tile, Product: Color Wheel; Classic Series or comparable product by one of the following:**
  - b. American Olean; a division of Dal-Tile Corporation
  - c. Crossville, Inc.
  - d. Architect approved equal
- 2. Composition: Ceramic.
- 3. Module Size: 6 inches x 6 inches.
- 4. Thickness: 5/16 inches.
- 5. Face: Glazed Ceramic.
- 6. Surface: Smooth. Without abrasive admixture.
- 7. Grout Color: **[GRT-1]** As selected by Architect from manufacturer's full range.

### B. Tile type **CT-4, CT-5, CT-6, CT-7**: Unglazed colorbody porcelain mosaic tile.

- 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. **Basis of Design: Dal-Tile, Series: Keystones or comparable product by one of the following:**
  - b. American Olean; a division of Dal-Tile Corporation
  - c. Crossville, Inc.
  - d. Architect approved equal
- 2. Composition: Ceramic.
- 3. Face Size: 1-inch x 1-inch mesh sheet and 2-inch x 2-inch mesh sheet.
- 4. Thickness: 1/4" inch.
- 5. Dynamic coefficient of Friction: Not less than the following:
  - a. Level Surfaces: 0.42.
- 6. Tile color and pattern: As selected by Architect from manufacturer's full range.

- C. Grout Color: **[GRT-2 and GRT-3 (at pool interior and deck)]** As selected by Architect from manufacturer's full range.

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
  - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.
  - 2. ADA compliant.

## 2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
  - 1. Fluid-applied Membrane: Liquid- latex rubber or elastomeric polymer.
  - 2. Products: 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. Ardex Americas: Ardex S 1-K One-component waterproofing compound.
    - b. Bonsai American, an Oldcastle company; B 6000 Waterproof crack isolation Membrane
    - c. Bostik, Inc; Bostik Gold Plus.
    - d. Laticrete International Inc.; Laticrete Hydro Ban or Hydro Barrier
    - e. MAPEI Corporation; Mapelastic Aqua Defense
  - 3. Miscellaneous Materials: Provide all required products for a complete installation including but not limited to:
    - a. Waterproofing and crack isolation membrane.
    - b. Preparation of existing concrete slab for new tile.
    - c. Primers.
    - d. Sealants.
  - 4. Warranty: Manufacturer's standard warranty.

## 2.6 UNCOUPLING MEMBRANE

- A. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Basis of Design: Schluter Systems L.P. or comparable product by one of the following:
    - b. Architect approved equal

## 2.7 SETTING MATERIALS

- A. Latex -Portland Cement Mortar (Thinset) Installation Materials: ANSI A118.4.
  - 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. Ardex Americas
    - b. Bostik, Inc.
    - c. Custom Building Products.
    - d. Laticrete International
    - e. MAPEI Corporation
  - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements of ANSI A 118.4.
- B. Sloping Mortar:
  - 1. Slope all PMT-1 mosaic tile down to the existing drains, within 2-3 feet of the drain, in all toilet rooms where it was previously sloped. Prep subfloor with sloping mortar as required at drain locations. The entirety of each toilet room floor will not be sloped, just within 2-3 feet of each drain.
  - 2. 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. Basis of Design: Custom Building Products, SpeedSlope.
    - b. Ardex Americas.
    - c. Bostik, Inc.
    - d. Laticrete International.
    - e. MAPEI Corporation.

## 2.8 GROUT MATERIALS

- A. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65g/L or less.

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. Bonsal American, an Oldcastle company.
  - b. Bostik, Inc.
  - c. Custom Building Products.
  - d. Laticrete International, Inc.
  - e. MAPEI Corporation.
2. Provide a product capable of withstanding continuous and intermittent exposure to temperatures up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

## 2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and patching compounds: Latex-modified, Portland-cement based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for wall and floor applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material. To be installed at all outside, corner, or exposed edges of tiles.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. **Basis of Design:** Schluter Systems L.P. or comparable product by one of the following:
    - b. Profilitec
    - c. Architect approved equal
  2. Profiles **TR-1: Basis of Design:** Schluter- JOLLY
    - a. Anodized Aluminum L-shaped, with 1/8-inch-wide top sections and vertical wall sections for outside corners of tiled surfaces on walls.
    - b. Edges at top of wall tile:
      - 1) Provide with matching inside corners
      - 2) Provide with matching outside corners
      - 3) Provide with internal connectors
      - 4) Provide with matching end caps
      - 5) Provide with matching Sealing Lip
    - c. Material and Finish: As selected by Architect from manufacturer's full range.
    - d. Height: 3/8 inch
  3. Profiles: **Basis of Design:** Schluter – Coverttec EP
    - a. Anodized Aluminum profile, for floors with the same height.
    - b. Material and Finish: As selected by Architect from manufacturer's full range.
    - c. Height: 6mm

- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Floor Sealer: Product for sealing grout joints and that does not change color or appearance of grout.
  - 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. **Basis of Design: NeverStrip Floor Coatings, Tile Seal.**
    - b. Bonsal American, an Oldcastle company.
    - c. Custom Building Products.
    - d. Jamo Inc.
    - e. Southern Grouts & Mortars, Inc.
  - 2. Install NeverStrip, Tile Seal on all new tile floors in the entire project.

## 2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

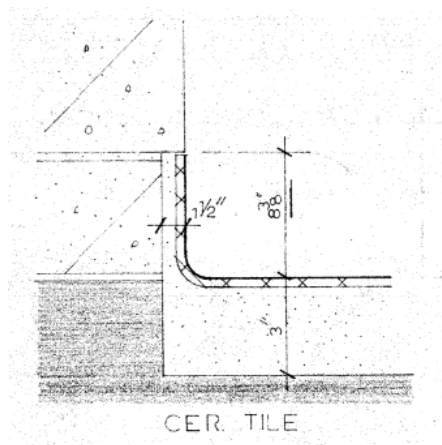
### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

- b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. At floor tile installs, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Prep subfloor per the Hydraulic Cement Underlayment Installation Schedule in Specification 035416.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Provide 2 layers of 5/8" tile backer board installed inside the existing toe kick void, full perimeter of each toilet room, in all toilet rooms receiving new wall tile in the entire project. See the existing Record Drawing detail below for reference.



### 3.3 CRACK ISOLATION MEMBRANE

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.



- B. Do not install tile or setting materials over crack isolation membrane until membrane is cured.

### 3.4 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - a. Tile floors and walls in wet areas.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tiles differ in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Ceramic Tile: 1/8 inch
- H. Layout tile wainscots to dimension as indicated or to next full tile beyond dimensions indicated.
- I. Expansion joints: Provide expansion joints and other sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install at locations indicated, per manufacturer's specifications.

### 3.5 TILE BACKING PANEL INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

### 3.6 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A 108.13 and manufacturer's written instructions to produce a waterproofing membrane of uniform thickness that is bonded securely to substrate.
  - 1. Prepare floor and wall surfaces as required by manufacturer.
  - 2. Install waterproofing under all new floor tiling shown in the drawings.
    - a. Run the waterproofing up 12 inches high on all walls.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- C. Seal floor tile and grout with the specified product. Remove residue from tile surfaces.

### 3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustical panels for interior ceilings.
  - 2. Exposed tee, direct-hung, suspension systems.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size tiles equal to 5 percent of quantity installed, but not less than (1) full carton.
  - 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 5 percent of quantity installed, but not less than (5) of each component and piece.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations:
  - 1. Suspended Acoustical Panel Ceilings: Obtain each type of acoustical ceiling panel and its suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Class A according to ASTM E 1264.
  - 2. Smoke-Developed Index: 450 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL or from the listings of another qualified testing agency.

### 2.3 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc. (Basis of Design).
  - 2. United States Gypsum Corporation.
  - 3. CertainTeed Corporation.
  - 4. Architect Approved Equivalent.

### 2.4 ACOUSTICAL UNITS

- A. Acoustical Panel: **(ACT-1) Basis-of-Design: Armstrong Canyon #1492.** Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classification as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
  - 1. Color: White
  - 2. ASTM E1264: Type A, Form A2.2, Pattern E, Fire Class A.

3. Light Reflectance (LR): Not less than 0.80.
4. Ceiling Attenuation Class (CAC): Not less than 35.
5. Noise Reduction Coefficient (NRC): Not less than 0.65
6. Articulation Class (AC): Not less than 170.
7. Edge/ Joint Detail: 15/16 Beveled Tegalur.
8. Thickness: 5/8 inch.
9. Modular Size: 24 by 24 inches.
10. Pattern: Non-directional.

- B. Acoustical Panel: **(ACT-2) Basis-of-Design: Armstrong Calla #2824**. Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classification as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

1. Color: White
2. ASTM E1264: Type A, Form A2.2, Pattern G, Fire Class A.
3. Light Reflectance (LR): Not less than 0.85.
4. Ceiling Attenuation Class (CAC): N/A.
5. Noise Reduction Coefficient (NRC): Not less than 0.85.
6. Articulation Class (AC): 170
7. Edge/ Joint Detail: 9/16 Square Tegalur.
8. Thickness: 1 inch.
9. Modular Size: 24 by 24 inches.
10. Pattern: Non-directional.

## 2.5 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. United States Gypsum Corporation (Basis of Design).
  2. Armstrong World Industries, Inc.
  3. CertainTeed Corporation
- B. Metal Suspension-System Standard: **Basis-of-Design: Prelude XL 15/16" Acoustical Suspension System**. Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.
1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted hot-dip galvanized, G30 (Z90) coating designation.
1. Color of Metal Suspension System: White.

## 2.6 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

## 2.7 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
  - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
  - 2. Finish: Color to match grid.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION OF SUSPENDED ACOUSTICAL PANEL CEILINGS

- A. Install suspended acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 6. Do not attach hangers to steel deck tabs.
  - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  - 9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches (305 mm) o.c.

#### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

#### 3.5 ADJUSTING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace panels and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123



## SECTION 095400 – EXTRUDED ALUMINUM SPECIALTY CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes

1. Acoustical metal ceiling panels.
2. Exposed grid suspension system.
3. Wire hangers, fasteners, main runners, cross tees, wall angle moldings and accessories.
4. Perimeter Trim.

#### 1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.

B. Samples: Minimum 6 inch by 6 inch samples of specified panel; 8 inch long samples of exposed edge molding and suspension system, including main runner and 4 foot cross tees.

C. Shop Drawings: Illustrating the layout and details of the ceilings. Show locations of items that are to be coordinated with or supported by the ceilings.

#### 1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide ceiling panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: Class A products.
  - a. Flame Spread: 25 or less.
  - b. Smoke Developed: 50 or less.

C. Acoustic Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

D. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, wet work i.e. gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

#### 1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

## 1.5 PROJECT CONDITIONS

A. Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.

B. Do not install the metal panels in spaces where the temperature or humidity conditions vary greatly from the temperatures and conditions that will be normal in the occupied space.

## 1.6 WARRANTY

A. Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:

1. Panels: Sagging and warping.
2. Grid System: Rusting and manufacturer's defects.

B. Warranty Period:

1. Metal panels: One (1) year from date of substantial completion.
2. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

## 1.7 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.
2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Ceiling Panels:

1. Basis of Design: Alpro Acoustical Systems
2. American Decorative Ceilings
3. Armstrong World Industries, Inc.
4. USG Corporation.
5. CertainTeed Corporation.
6. Architect approved equal.

B. Suspension Systems:

1. Basis of Design: Alpro Acoustical Systems
2. American Decorative Ceilings
3. Armstrong World Industries, Inc.
4. USG Corporation.
5. CertainTeed Corporation.
6. Architect approved equal.

## 2.2 METAL PANEL TYPE

A. 1. Suspension System: Basis of Design

1. Extruded aluminum as manufactured by ALPRO, Division of Gordon, Inc. shall consist of main tees, cross tees, perimeter angle, perimeter trim, and any necessary clips and splices required for a complete system as required to meet local building codes.
2. Deflection of grid shall be limited to  $L/360$  of the span when full dead load is applied. (ASTM C 635)
3. Aluminum Extrusions shall be 6063-T6 alloy. (ASTM B 221, ASTM B 221 M)
4. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest grade -commercial type,

B. Metal Panels: Basis for Design

1. Choose from the following selections for exposed metal. Aluminum sheet shall be 3003-H14 alloy, minimum .032" recommended, (ASTM B 209).
2. The metal acoustical Ceiling Panels shall be corrugated using (Specified ALPRO Pattern AI) and perforated with 1/8" diameter holes on 21/64" staggered centers, approximately 13% open area.
3. The panels shall be fabricated of smooth aluminum (.032").
4. Sound Absorption Material:
  - a. Provide fiberglass (2") X (1.5 #). The fiberglass panel shall be wrapped in Class A, per ASTM E84, (Black Polyethylene).

## 2.3 FINISHES

C. Powder Coat Finish - (Interior use only)

1. All ALPRO Panels & Accessories shall receive a micro-etched pretreatment

- prior to receiving an electrostatically applied powder coat paint finish.
2. All cut edges, including perforated holes must be coated. Finish shall be cured and oven baked to insure paint adhesion and uniform surface hardness.
  3. Paint Color to be selected from ALPRO Standard Colors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.
- B. Proper designs for both supply air and return air, maintenance of the HVAC filters and building interior space are essential to minimize soiling. Before starting the HVAC system, make sure supply air is properly filtered and the building interior is free of construction dust.

### 3.2 PREPARATION

- A. Install specified metal panel ceilings where indicated on Drawings. Coordinate panel layout with mechanical and electrical fixtures.

### 3.3 INSTALLATION

- A. Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines; approved construction drawings; with the authorities having jurisdiction; and in accordance with the manufacturer's installation instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095400

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Thermoplastic Rubber Cove Base.
  - 2. Vinyl Molding Accessories.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

#### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### 1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 THERMOPLASTIC-RUBBER COVE BASE (RCB)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. **Basis of Design: Roppe Corporation, USA, 700 Series.**
  - 2. Armstrong Flooring, Inc.
  - 3. Tarkett S.A..
  - 4. Architect approved equal.
- B. Product Standard: ASTM F 1861, Type TP (thermoplastic rubber and vinyl), Group 2.
  - 1. Style and Location:
    - a. Style B, Traditional Toe Cove Profile.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As selected by Architect from full range of industry colors.

### 2.2 VINYL MOLDING ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. **Basis of Design: Roppe Corporation, USA, #50 tile/carpet joiner 7/32".**
    - a. Armstrong World Industries, Inc.
    - b. Profilitec.
    - c. Architect approved equal.
  - 2. Description: Transition strips for resilient tile and textile composite flooring, contour edge profile for installation around flooring curves.
  - 3. Profile Types and Dimensions: Provide basis of design profiles indicated in the drawings.
  - 4. Locations: Provide vinyl molding accessories where indicated on the drawings.
  - 5. Colors and Patterns: As selected by Architect from full range of standard colors.

6. Installation: Direct Glue.

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based, or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Rubber Base and Molding Adhesives: (Basis-of-Design) Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  1. Roppe WB-600\_Acrylic Wall Base Adhesive.
  2. Roppe: AW-510\_Acrylic Wet-Set Adhesive.
  3. Roppe: C-630\_Water-Based Contact Adhesive.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513



## SECTION 096519 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Luxury Vinyl Tile (RT).
  - 2. Metal edge trim, profile strips, and thresholds.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient floor tile. Use same designations indicated on Drawings.
  - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color, texture, and pattern of floor tile required.
- E. Flooring and Adhesive Manufacturer Recommended Moisture, Alkalinity, and Adhesion Tests.
  - 1. Prior to Testing, submit PLAN (drawings) of proposed Test locations to Architect.
  - 2. Results of Tests shall be submitted to Architect prior to Pre-Installation Conference for review.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.6 MANDATORY PRE-INSTALLATION CONFERENCE

- A. Conduct Pre-Installation Conference at Project site to comply with requirements in Division 01 Section “PROJECT MANAGEMENT AND COORDINATION”.
- B. The following is a list of required attendees:
  - 1. Owner or Owner’s Representative.
  - 2. Architect and Interior Designer.
  - 3. General Contractor.
  - 4. Flooring Contractor with person responsible for testing required by this specification.
  - 5. Flooring Manufacturer’s Representative.
- C. The following constitutes mandatory discussion items that can be expanded per Project needs:
  - 1. Finalize construction schedule and ensure availability of materials, installer's personnel, equipment, and facilities needed to avoid delays. Required Concrete Testing shall be major item of consideration in Schedule, as successful installation of flooring material, depends on proper testing and assessment of test results.
  - 2. Analyze methods and procedures related to flooring installation, including manufacturer's written instructions and reach agreement for their conformance. Ensure that 100 lb Roller is used on the Project.
  - 3. Develop procedures to determine condition and Contractor’s acceptance of existing substrates for installation of new flooring.
  - 4. Review existing flooring material removal procedures and Owner notifications.
  - 5. Finalize “On Site Storage” arrangements for flooring materials.
  - 6. Ensure substrate conditions and finishes are in compliance with requirements, including flatness and cleanliness.
    - a. Start of flooring Work constitutes acceptance of surfaces to be covered and contractors adherence to the criteria contained in this specification.
  - 7. Discuss governing regulations and requirements for insurance and certificates if applicable.
  - 8. Cover temporary protection requirements for flooring system during and after installation.
  - 9. Outline flooring observation and repair procedures after installation.
  - 10. Set procedure for preserving the environmental conditions of the spaces where flooring installations shall take place.
  - 11. Stress that expectations for high quality installations based on: Excellent materials, testing, use of Certified Master Mechanics only, addition of underlayments when necessary, and on-site supervision with complete understanding of importance of adherence to manufacturer’s instructions.
  - 12. Determine area of Mock-up (if applicable), review the results when completed, and implement necessitated revisions.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage installer competent in technique required by manufacture.
  - 2. It is required that the installation firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or Certified Floorcovering

Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) minimum years documented experience in commercial installation of these materials.

- a. Certified Installer must be always present on job site during floor covering installation
  3. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
  4. Flooring contractor will be responsible for the proper product installation, including floor preparation in all areas indicated in the drawings to receive resilient flooring.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Make sure all material is from the same batch number.
- C. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F. Store floor tiles on flat surfaces and squarely on top of one another.
  1. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
    - a. Preferably, locate material in the "center" of the installation area (i.e. away from vents, direct sunlight, etc.)
  2. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
  3. Refer to manufacturer's product installation recommendation for a complete guide on project conditions.
- D. When palletizing on a jobsite, vinyl plank or tiles need to be stacked 2 rows high side by side with no airspace in between. Then quarter turned for 2 rows side by side. Do not stack more than 5 cartons high. A 5/8" or thicker plywood must also be placed on the pallet first.
  1. Do not stack pallet's 2 high unless utilizing a 1" thick plywood in between pallets.

#### 1.9 FIELD CONDITIONS

- A. HVAC System: Must be operational, maintaining the following conditions 7 days prior to, during, and after installation.
- B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F in spaces to receive floor tile during the following periods:
  1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.

- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F.
- E. Close spaces to traffic during floor tile installation.
- F. Close spaces to traffic for 48 hours after floor tile installation.
- G. Install floor tile after other finishing operations, including painting, have been completed.

#### 1.10 LIMITED WARRANTY

- A. Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- B. Limited Warranty Period (RT-1): 15 years.
- C. Limited Warranty Period (RT-2): 25 years.
- D. Limited Warranty shall not deprive the Owner of the other rights the Owner may have under other provision of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

#### 2.2 LUXURY VINYL TILE (RT-1)

- 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. **Basis of Design Product**: Subject to compliance with requirements, provide; **Interface, Inc., Natural Woodgrains LVT**. Or comparable product by one of the following:
    - a. Armstrong Flooring, Inc.
    - b. Patcraft Inc.
    - c. Mannington Mills, Inc.
    - d. Shaw Contract, Inc.
    - e. Tarkett, S.A.
    - f. Architect approved equal.
- B. Tile Standard:

1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
2. Fire Class A/Class I.
3. Thickness: 0.177 inches (4.5mm).
4. Size: 25 cm by 1 m.
5. Wear Layer: 22 mil.
6. Finish: Ceramor.
7. Edge Profile: Square.
8. IIC Sound Rating: 64 IIC.
9. Colors: As selected by Architect from manufacturer's full range of available options.
10. Locations: Where indicated on drawings.
11. Installation Pattern: Manufacturer's standard variable Ashlar.
  - a. Existing wood subfloors should be covered with 1/4" or APA approved underlayment plywood.
    - 1) Use 1/4" thick underlayment panels for boards with a face width of 3" or less. Glued and screwed down to wood subfloor below.

### 2.3 LUXURY VINYL TILE (RT-2)

- 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. **Basis of Design Product**: Subject to compliance with requirements, provide; **Patcraft, Inc., NuMix LVT**. Or comparable product by one of the following:
    - a. Interface, Inc.
    - b. J+J Flooring.
    - c. Architect approved equal.
- B. Tile Standard:
  1. Class ASTM F1700: Class I – monolithic solid vinyl tile Type A (smooth)
  2. Slip Resistance ASTM D2047: ADA Compliant
  3. Static Load Limit ASTM F970: 1500 psi
  4. Residual Indentation F1914: passes , 8%
  5. Flexibility ASTM F137: Passes
  6. Resistance to Heat ASTM F1514: Passes
  7. Resistance to Light ASTM F1515: Passes
  8. Resistance to Chemicals ASTM F925: Passes
  9. Radiant Flux ASTM E648: / 0.45 W/sq. cm., Class I
  10. Smoke Density ASTM E662: Passes, <450
  11. Wear-layer Thickness: 0
  12. Overall Thickness: 0.125 inches (3.17 mm)
  13. Nominal Dimensions: 36 in x 36 in
  14. Colors: As selected by Architect from manufacturer's full range of available options.
  15. Installation Pattern: Quarter Turn installation method.

### 2.4 METAL EDGE TRIM, PROFILE STRIPS & THRESHOLDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following as stated in each profile section or a comparable product by one of the following:

1. **Basis of Design Product:** Subject to compliance with requirements, provide; **Profilitec, Striptec ST transition strip**. Or comparable product by one of the following:
  - a. Blanke Corporation.
  - b. Schluter Systems L.P.
  - c. Tarkett S.A..
  - d. Architect Approved Equal.
2. Description: Transition strips for resilient tile flooring to terrazzo flooring.
3. Profile and Dimensions: Provide basis of design profiles indicated in the drawings.
4. Locations: Provide metal molding accessories where indicated on the drawings.
5. Colors and Patterns: As selected by Architect from full range of standard colors.
6. Installation: Mechanically fastened.

## 2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide NeverStrip Vinyl Seal Floor Coating on all new resilient flooring.
  1. Clean and remove all dirt and debris from LVT flooring.
  2. Surface must be dry before applying Vinyl Seal.
  3. All surfaces not to be coated should be protected with tape or plastic.
  4. Apply 2-3 coats of Vinyl Seal product on flooring. Burnish Vinyl Seal with a white pad following each coat, or as recommended by manufacturer.
  5. Install product per manufacturer's written instructions.
  6. Product does not need to be stripped in its normal lifecycle.
- D. Metal Edge Strips: Stainless Steel transition strip, of width indicated on the Drawings, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
  1. Basis of Design profile: Profilitec, Striptec ST transition strip.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
1. Prepare concrete substrates in accordance with ASTM F 710.
    - a. Concrete floors must be free of dust, solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitance, mold, mildew, and other foreign materials that may affect dissipation rate of moisture from the concrete, discoloration or adhesive bonding.
    - b. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
    - c. Moisture Testing: Proceed with Installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following.
      - 1) Perform anhydrous calcium chloride test according to ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      - 2) Perform relative humidity test using in situ probes according to ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using in situ Probes. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
    - d. A pH test for alkalinity must be conducted on the concrete floor prior to installation with results conforming to manufacturer requirements. If the test results are not within the acceptable range, then installation must not proceed until the problem has been corrected.
  2. Wood subfloors must have a minimum 18" of cross-ventilated space beneath the bottom of the joist.
    - a. The floor must be rigid, free of movement.
    - b. Single wood and tongue and groove subfloors should be covered with 1/4" or APA approved underlayment plywood.
      - 1) Use 1/4" thick underlayment panels for boards with a face width of 3" (76 mm) or less. Glued and screwed down to wood subfloor below.
    - c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.
  3. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement-based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
  4. Floor covering shall not be installed over expansion joints.
  5. Do not install resilient products until they are the same temperature as the space where they are to be installed.
    - a. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  6. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 LUXRY VINYL FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis in pattern indicated .
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay planks with grain direction and arrows all facing the same direction in pattern indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Roll the flooring in both directions using a 100 pound three-section roller.
- J. Use appropriate protectors under furniture. These should be felt or other soft material specifically designed to protect the hard surface from scratches or damage to the wear layer.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.



- C. Protect floor tile from marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Luxury Vinyl Tile Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Apply floor polish per manufacturer's written instructions.
  - 2. No traffic for 24 hours after installation.
  - 3. No heavy traffic, rolling loads, or furniture placement for 48 hours after installation.
- E. Cover floor tile until Substantial Completion.
- F. Wait 48 hours after installation before performing initial cleaning.
- G. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 096519

## SECTION 09 6723 - RESINOUS FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

- A. High-performance resinous flooring systems (RF-1).
- B. Epoxy wall coating system (RF-2).

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: Submit three 6" X 6" samples of each resinous flooring system applied to a rigid backing. Provide samples that are a true representation of the proposed field applied finish for chip color and finish texture review. Provide the sample colors and textures for approval from the Owner in writing.
- C. Mockup for Final Verification: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
  - A. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
    - a. Include 96-inch length of integral cove base with inside and outside corner.
  - B. Finish surfaces for verification of products, color, texture, and sheen.
  - C. Simulate finished lighting conditions for Architect's review of mockups.
  - D. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - E. Mockup shall demonstrate desired slip resistance for review and approval by Owner's representative in writing.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.
- C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.
- D. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

- E. Pre-Installation Conference: Conduct conference at Project site before work and mockups begin.
- F. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mockup area.
  - A. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
  - B. Finish surfaces for verification of products, color, texture, and sheen.
  - C. Simulate finished lighting conditions for Architect's review of mockups.
  - D. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - E. Mockup shall demonstrate desired slip resistance for review and approval by Owner's representative in writing.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Obtain Decorative Mosaic Coating System materials from a single manufacturer with a minimum of 10 years verifiable experience providing materials or the type specified in this section.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
- C. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- D. Installation must be performed by a manufacturer approved contractor with skilled mechanics having not less than five (5) satisfactory years of experience in the installation of the type of system as specified and must be approved in writing by the manufacturer.
- E. Installer Letter of Certification: installer to provide letter stating that they have been in business for at least 10 years and listing 5 projects in the last 2 years of similar scope. For each project, provide project name, location, date of installation, contact information, size of project, and manufacturer of materials with system information.
- F. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- G. **Pre-installation Conference: Conduct conference at Project site 6 weeks before work and mockups begin.**

## 1.6 WARRANTY

- A. The contractor and the manufacturer shall furnish a standard guarantee of the flooring system for a period of one (1) year after installation. The labor and material guarantee shall include loss of bond and wear-through to the concrete substrate from normal use.
- B. Not included in the warranty are damage due to structural design deficiencies including, but not limited to slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to equipment, delamination by vapor transmission, Acts of God, or other elements beyond the scope of protection of the flooring system nor causes not related to the systems materials.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels clearly marked with the following:
  - A. Product brand name and/or number(s)
  - B. Manufacturer's name
  - C. Component designation (A, B, etc.)
  - D. Product Mix Ratio
  - E. Health and Safety Information
  - F. CHEMTREC Emergency Response Information
- B. Provide equipment and personnel to handle the materials by methods which prevent damage.
- C. The contractor shall promptly inspect direct jobsite material deliveries to assure that quantities are correct, comply with requirements and are not damaged.
- D. The contractor shall be responsible for materials furnished by him, and he shall replace, at his own expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling or storage.
- E. Store material(s) in accordance with manufacturer's instructions, with seals and labels intact and legible. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer's maximum recommended shelf life.
- F. Maintain containers in clean condition, free of foreign materials and residue.
- G. Remove rags and waste from storage areas daily.

## 1.8 FIELD CONDITIONS

- A. The contractor shall visit the jobsite prior to the installation of the flooring system to evaluate substrate condition, including substrate moisture transmission, quantity and severity of cracking, and the extent of repairs needed. Substrate imperfections should be repaired only after mechanical preparation of the substrate.
- B. Surface preparation reveals most imperfections requiring repair. Concrete substrates shall be tested to verify that the moisture vapor transmission of the substrate does not exceed the floor

systems manufacturer's recommendations. Cost associated with repair, leveling and remediation of the substrate are the responsibility of the provider of the substrate.

- C. The contractor should exercise care during surface preparation and system installation to protect the surrounding substrates and surfaces, as well as in-place equipment. The contractor shall prepare the substrate to remove laitance and open the surface. This shall be achieved by light brush grit blasting. Surface profile achieved shall be similar to medium grit sandpaper and free from bond-inhibiting contaminants. Cost incurred that are associated with damage from negligence or inadequate protection shall be the sole responsibility of the contractor.
- D. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- E. Sub floor tolerances are specified in Section 03 3000 "Cast-In-Place-Concrete (in accordance with ACI 302). Each drain in the installation area must be working and raised or lowered to the actual finished elevation of the flooring system.
- F. System must be protected by the General Contractor until it is inspected and turned over to the owner.
- G. The minimum slab temperature must be conditioned to 60 degrees F before commencing installation, during installation, and for at least 72 hours after installation is complete. The substrate temperature must be at least 5 degrees F above the dew point during installation.
- H. Maintain lighting at a minimum uniform level of 50 or more-foot candles in areas where the flooring system is being installed. It is the recommendation of the manufacturer that the permanent lighting be in place and working during installation.
- I. Leaks from pipes and other sources must be corrected prior to the installation of the flooring system.
- J. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Abrasion Resistance (ASTM D 4060, CS-17 Wheel, 1,000 cycles: 63 mgs lost
- B. Flexural Strength (ASTM C 580): 10,000 psi
- C. Adhesion (ACI 503R): 300 psi concrete failure
- D. Flammability (ASTM D 635): Self-extinguishing over concrete
- E. Impact Resistance (MIL-D-3134J): Direct, inch pound greater than 160, passes. Reverse, inch pound greater than 80, passes.

- F. Resistance Elevated Temperatures (MIL-D-3134J): No slip or flow at required temperature of 158 degrees F.

## 2.2 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

## 2.3 RESINOUS FLOORING SYSTEM (RF-1)

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

- a. **Basis of Design: The Sherwin Williams High Performance Flooring**
- b. Terrazzo & Marble Supply Company.
- c. Stonhard.
- d. Dex-O-Tex.
- e. Dur-A-Flex.
- f. Architect approved equal.

- B. **Basis of Design Product (RF-1): Sherwin Williams Hyrbi-Flex EQ (self leveling broadcast quartz), epoxy/aliphatic urethane topcoat seamless flooring system.**

- a. System Materials:

- 1) Topping: Sherwin Williams Poly-Crete SL resin, hardener, and SL aggregate.
- 2) The broadcast aggregate shall be Sherwin Williams Q11 quartz aggregate.
- 3) Broadcast: Sherwin Williams Resuflor Glaze epoxy based two-component resin.
- 4) Grout Coat: Sherwin Williams Resuflor Glaze Clear, epoxy-based, resin, and hardener.
- 5) Top Coat: Sherwin Williams Resutile AT aliphatic urethane two-component resin.

- b. Patch Materials:

- 1) Shallow Fill and Patching: Use Sherwin Williams Poly-Crete MD (up to ¼ inch).
- 2) Deep Fill and Sloping Material (over ¼ inch): Use Sherwin Williams Poly-Crete WR or Cemlack UM.

- c. System Characteristics:

- 1) Color and Pattern: As selected by Architect from manufacturer's full range of standard color options.
- 2) Wearing Surface: Textured for slip resistance.
- 3) Overall System Thickness: 3/16 inches built-up system.

- C. Product Requirements:

- a. Topping: Poly-Crete SL
  - 1) Percent Reactive: 100 %

- 2) VOC: 0 g/L
- 3) Bond Strength to Concrete ASTM D 4541: 400 psi, substrates fails
- 4) Compressive Strength, ASTM C 579: 9,000 psi
- 5) Tensile Strength, ASTM D 638: 2,175 psi
- 6) Flexural Strength, ASTM D 790: 5,076 psi
- 7) Impact Resistance @ 125 mils, MIL D-3134: 160 inch lbs  
No visible damage or deterioration
- b. Broadcast Coat: Resuflor Glaze
  - 1) Percent Reactive: 100 %
  - 2) VOC: <4 g/L
  - 3) Water Absorption, ASTM D 570: 0.04%
  - 4) Tensile Strength, ASTM D 638: 4000psi
  - 5) Coefficient of thermal expansion  
ASTM D 696:  $2 \times 10^{-5}$  in/in/F
  - 6) Flammability ASTM D-635: Self-Extinguishing
  - 7) Flame Spread/ NFPA 101 ASTM E-84: Class A
- c. Grout Coat: Resuflor Glaze Clear
  - 1) Percent Reactive: 100 %
  - 2) VOC: <4 g/L
  - 3) Water Absorption, ASTM D 570: 0.04%
  - 4) Tensile Strength, ASTM D 638: 4000psi
  - 5) Coefficient of thermal expansion  
ASTM D 696:  $2 \times 10^{-5}$  in/in/F
  - 6) Flammability ASTM D-635: Self-Extinguishing
  - 7) Flame Spread/ NFPA 101 ASTM E-84: Class A
- d. Topcoat: Resutile AT
  - 1) VOC: 0 g/L
  - 2) 60 Degree Gloss ASTM D523: 75 +/- 5
  - 3) Mixed Viscosity, (Brookfield 25 C): 500 cps
  - 4) Tensile strength, ASTM D 638: 7,000 psi
  - 5) Abrasion Resistance, ASTM D4060: Gloss  
CS 17 wheel (1,000 g load) 1,000 cycles: 4 mg loss with grit, 10 mg loss without grit
  - 6) Abrasion Resistance, ASTM D4060: Satin  
CS 17 wheel (1,000 g load) 1,000 cycles: 8 mg loss with grit, 12 mg loss without grit
  - 7) Pot life @ 70 F 50% RH: 2 hours
  - 8) Full Chemical resistance: 7 days

## 2.4 EPOXY WALL COATING SYSTEM (RF-2)

- A. Epoxy Wall Coating: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic wall surfacing designed to produce seamless vertical surfaces.
  - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. **Basis of Design: The Sherwin Williams High Performance Flooring**
    - b. Terrazzo & Marble Supply Company.
    - c. Stonhard.
    - d. Dex-O-Tex.
    - e. Dur-A-Flex.

- f. Architect approved equal.

**B. Basis of Design Product (RF-2): Sherwin Williams Resuwall VC, epoxy-based, urethane topcoat chip seamless wall system.**

- a. System Materials:
- 1) Broadcast Coat: Sherwin Williams Resuflor Gard No Sag resin and hardener.
  - 2) Chips: Sherwin Williams decorative chips (Micro or Macro)
  - 3) Grout Coat: Sherwin Williams Resuflor Glaze resin and hardener.
  - 4) Topcoat: Sherwin Williams Armor Top resin and hardener.
- b. Patch Materials:
- 1) Shallow Fill and Patching: Use Sherwin Williams Resuflor Cove Rez.
- c. System Characteristics:
- 1) Color and Pattern: As selected by Architect from manufacturer's full range of standard color options.
  - 2) Overall System Thickness: 3/16 inches built-up system.

**C. Product Requirements:**

- a. First Broadcast Coat: Resuflor Gard No Sag
- 1) Percent Solids: 100%
  - 2) VOC: 3.45 g/L
  - 3) Compressive Strength, ASTM D 695: 16,000 psi
  - 4) Tensile Strength, ASTM D 638: 3,800 psi
  - 5) Flexural Strength, ASTM D 790: 4,000 psi
  - 6) Abrasion Resistance, ASTM D 4060  
C-10 Wheel, 1,000 gm load, 1,000 cycles: 35mg loss
  - 7) Flame Spread/NFPA-101, ASTM E 84: Class A
  - 8) Flammability, ASTM D 365: Self Extinguishing
  - 9) Impact Resistance MIL D-3134: 0.025 inch Max
  - 10) Water Absorption MIL D-3134: 0.04%
  - 11) Potlife @ 70 F: 20-25 minutes
- b. Second Broadcast Coat and Grout Coat: Resuflor Glaze
- 1) Percent Solids: 100%
  - 2) VOC: 3.8 g/L
  - 3) Compressive Strength, ASTM D 695: 11,200 psi
  - 4) Tensile Strength, ASTM D 638: 2,100 psi
  - 5) Flexural Strength, ASTM D 790: 5,100 psi
  - 6) Abrasion Resistance, ASTM D 4060  
C-10 Wheel, 1,000 gm load, 1,000 cycles: 29mg loss
  - 7) Flame Spread/NFPA-101, ASTM E 84: Class A
  - 8) Impact Resistance MIL D-24613: 0.0007 inches, no cracking or delamination
  - 9) Water Absorption MIL D-24613: Nil
  - 10) Potlife @ 70 F: 20 minutes
- c. Topcoat: Resuflor Armor Top
- 1) VOC: 0 g/L
  - 2) 60 Degree Gloss ASTM D 523: 75 +/- 5
  - 3) Mixed Viscosity, (Brookfield 25 C): 500 cps
  - 4) Tensile Strength, ASTM D 638: 7,000 psi
  - 5) Abrasion Resistance, ASTM D 4060: Gloss



- CS 17 wheel (1,000 g load) 1,000 cycles: 4mg loss with grit, 10mg loss without grit
- 6) Abrasion Resistance, ASTM D 4060: Satin  
CS 17 wheel (1,000 g load) 1,000 cycles: 8mg loss with grit, 12mg loss without grit
- 7) Pot life @ 70 F, 50% RH: 2 hours
- 8) Dry properties, 70F, 50% RH: 8 hours tack free, 12 hours Dry  
60F, 30% RH: 12 hours tack free, 18 hours Dry  
80F, 70% RH: 4 hours tack free, 6 hours Dry
- 9) Flash Point PMCC: 186 F
- 10) Full Chemical Resistance: 7 days

## 2.5 MATERIALS:

- A. VOC Content of Resinous Flooring:
  - 1. Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
    - a. Resinous Flooring: 100 g/L.
- B. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- C. Waterproofing Membrane: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- D. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
- E. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.
- B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable, try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile numbers as follows:

- |    |                                        |                 |
|----|----------------------------------------|-----------------|
| a. | Thin film, to 10 mils                  | CSP-1 to CSP-3  |
| b. | Thin and medium films, 10 to 40 mils   | CSP-3 to CSP-5  |
| c. | Self-leveling mortars, to 3/16"        | CSP-4 to CSP-6  |
| d. | Mortars and laminates, to 1/4" or more | CSP-5 to CSP-10 |
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
- A. Moisture Testing: Perform tests indicated below.
- a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lbs. of water/1000 sq. ft. in 24 hours. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq. ft.
- b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.
- D. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- A. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- B. At existing concrete slab saw cuts:
- a. Install Separate, double L-type angles, positioned back to back, white zinc-alloy, and in depth and length required for resinous flooring installation. Provide an elastomeric sealant joint as specified in 079200 "Joint Sealants" with joint thickness to match the saw cut width, minimum 1/8-inch, maximum 1/4 inch. Sealant joint color to match the resinous flooring.
- C. Where slab has cracked, route out all large or visible cracks a minimum of 1/8" wide and fill with Terroxy Fill. Smaller cracks can be filled with fiberglass mesh. Install the same type of double "L" control joint at large crack locations.

### 3.2 ENVIRONMENTAL CONDITIONS

- A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers' installation instructions shall be implicitly followed.
- B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
- C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

- F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

### 3.3 APPLICATION

- A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
  - A. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
  - B. Install topcoat over flooring after excess aggregate has been removed.
  - C. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.
- B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
  - A. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - B. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - C. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer's written recommendations.
- D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- E. Slip Resistant Finish: Provide grit for slip resistance.
- F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.
  - A. The flooring system is to be installed directly over non-moving control joints and cracks which have been treated with epoxy, and the flooring system will terminate at the edge of isolation and expansion joints as designated by the Architect.
- G. Cracks: After preparation, evaluation of quantity and severity of cracks in concrete will determine the needed repairs. Original bid assumes repair and treatment of 50 linear feet, determined by the Architect of cracks and control joints. Refer to the manufacturer's recommendations.
- H. Control Joints: refer to the manufacturer's recommendations.
- I. Reinforcing Membrane: Apply reinforcing membrane to entire substrate surface.
- J. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and top coating of cove base. Round internal and external corners.
  - A. Integral Cove Base: 4 inches high.

- K. System Primer and Base Coat: Apply water-based epoxy wall/floor coating as per manufacturer's recommendations.
- L. Chip Broadcast: Apply decorative vinyl chip aggregate as per manufacturer's recommendations.
- M. Grout Coat: Apply grout coat, of type recommended by flooring manufacturer, to fill voids in surface of final body coat.
- N. Top (Seal) coats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
  - A. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
  - B. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
  - C. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: At the direction of Owner and at locations designated by Owner, take five (5) core samples per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.
  - A. Cored areas less than specified thickness shall be removed and replaced or increased in thickness by the installing contractor, in a manner that does not affect the performance or integrity of the system. Cored areas which comply with the recommended system thickness shall be built-up to match the surrounding surface elevation prior to applying the seal coat(s). Cores taken and patched will be noticeable; therefore, cores should be taken from areas where aesthetics are less critical. Cost associated with repair of cored areas that comply with specification thickness area the responsibility of the provider of the substrate.

### 3.5 PROTECTION

- A. Cure the decorative floor coating system materials in compliance with the manufacturer's directions, taking care to prevent contamination during stages of the installation and prior to completion of the curing process.
- B. Protect decorative flooring system from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

- C. Clean the decorative floor coating system just prior to final inspection, using materials and procedures suitable to the system's manufacturer.
- D. Some cleaners will affect the color, gloss or texture of your polymer floor surfaces. To determine how a cleaner will perform, first test each cleaner, in a small area, utilizing your cleaning technique. This precaution will demonstrate the effect of your cleaner and technique. If no deleterious effects are observed, continue with the procedure. If deleterious effects occur, modify the cleaning material and/or procedure. For recommendations regarding types of cleaners, contact the decorative floor coating system's manufacturer.

END OF SECTION 09 6723

## SECTION 096814 - TEXTILE COMPOSITE FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Modular textile composite flooring.

#### 1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with the Work of other Sections.
  - 1. Sequencing: Conform to construction schedule. Sequence flooring installation to minimize possibility of damage and soiling of flooring during remainder of construction period.
  - 2. Division 09 Sections for other types of flooring and wall base.
- B. Pre-Installation Conference: Arrange, to comply with Division 01 requirements for Project meetings.
- C. Scheduling for Concrete Slab and Flooring Installations: Allow sufficient time after placement of slab to allow concrete to reach acceptable internal slab moisture or humidity before installing flooring.
  - 1. General Guidelines: After slab is protected by watertight roof, allow for 3.0 - 5.0 pounds moisture emissions in 1000 square foot area in 24 hours for 4 inch thick, 4,000 psi concrete slab at 73 degrees F air temperature, 50 percent relative humidity, with undamaged underslab vapor barrier:
    - a. 0.40 Water/Cement Ratio: 42 days.
    - b. 0.50 Water/Cement Ratio: 82 days.
    - c. 0.80 Water/Cement Ratio: 117 days.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings:
  - 1. Minimum, same scale as Contract Drawings, showing textile composite flooring locations and layout.
  - 2. Show columns, doorways, enclosing walls/partitions, built-in cabinets and locations where cutouts are required in flooring.
- B. Product Data: Manufacturer's published technical product data for each type of textile composite flooring and accessory item.
- C. Samples: Full-sized sample of each type of flooring and color/pattern/texture to be provided under this Section, with manufacturer's label and data sheet permanently attached.
- D. Strike-Offs: As requested to obtain color and pattern, acceptable to Architect.
  - 1. Costs charged to Owner and Architect for strike-offs are not accepted.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualifications Statements: Manufacturer and Installer, documenting qualifications specified in this Section.
- B. Manufacturer Compliance Certification: Submit letter stating that flooring materials to be used under the Work of this Section conform to specified flammability requirements and other requirements of Contract Documents, with certified signature and name of legally authorized officer of manufacturing plant.

1. List mill register numbers for flooring furnished.
  2. Support for certified independent laboratory test data indicating that flooring meets or exceeds specified test requirements.
  3. Include CRI Green Label Plus Indoor Air Quality (IAQ) Control Category Registration Number and NSF 140 Certification Standard and Certification Level.
- C. Manufacturer's Instructions: Include installation requirements, special procedures, and conditions requiring special attention.
- D. Field quality control reports.
- 1.5 MAINTENANCE MATERIAL SUBMITTALS
- A. Submit to Owner at Contract closeout. Obtain receipt.
- B. Extra Stock Materials:
1. Two complete cartons, of approximately 18 modules in each carton, for each type of textile composite flooring used in Project.
  2. Furnish from same mill run as installed flooring.
  3. Package in manufacturer's protective plastic wrapping.
  4. Include manufacturer's identifying label and product data sheet identifying product, style, color, pattern, and physical characteristics.
- C. Maintenance Data: Include manufacturer's instructions for maintenance procedures, maintenance products, and cleaning schedule.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications:
1. Company specializing in work of this Section. Able to document minimum 20 years of experience and manufacturing commercial flooring.
  2. Manufacturing facility ISO 14001 certified.
- B. Installer Qualifications:
1. Company specializing in commercial flooring and carpet installation.
  2. Member of Floor Covering Installation Contractors Association (FCICA) or certified by the Certified Floorcovering Installers Association (CFI).
  3. Minimum 3 years of documented experience in commercial installations of similar flooring materials, including preparation.
  4. Trained and authorized by manufacturer as qualified to perform work of this Section.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver until construction work causing moisture, dust, soiling, and potential damage to textile composite flooring is complete.
- B. Arrange for suitable storage inside Building, in well ventilated area, protected from weather, moisture and soiling.
- C. Conform to manufacturer's instructions. Deliver and store in original, unopened, protective containers and packaging with seals intact and labels clearly identifying product name, manufacturer, and mill register numbers.
- D. Store in a safe, protected location, where available for inspection.
- E. Handle in a manner to protect from damage.
- F. Do not remove protective packaging and identifying labels until required.

## 1.8 FIELD CONDITIONS

- A. Store flooring materials and adhesive at minimum 65 degrees F and maximum 95 degrees F temperature, and at minimum 10 percent and maximum 65 percent relative humidity, for 48 hours prior to installation, and during and following installation.
- B. Protect from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Provide sufficient heat, light and power required for effective and efficient working conditions.
- C. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the modules within the installation area and allow them to precondition for 48 hours prior to installation.
- D. Inspect flooring materials prior to installation for proper style, color and potential defects. Immediately notify Architect and manufacturer of possible problems with materials.
- E. Module installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved and completed. Traffic shall be closed during the installation of the textile composite flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer's installation instructions.

## 1.9 WARRANTY

- A. Manufacturer's Standard Lifetime Warranty: Issued by the manufacturer as standard published warranty on all types of flooring modules within this document. Second source warranties that involve parties other than the textile composite flooring manufacturer are unacceptable. If the product fails to perform as warranted when installed according to manufacturer's written installation instruction and maintained according to manufacturer's written maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. Manufacturer will provide standard published written performance warranties for the following:
  - 1. Lifetime product performance. Will not delaminate along seams or lose more than five percent by weight of fiber during its useful life. Protection from Edge Ravel and Delamination Failure; Lifetime Dimensional Stability.
  - 2. Lifetime static propensity, meaning built-in protection below 3.0 kv as tested under AATCC-134.
  - 3. Lifetime Stain Removal.
  - 4. Lifetime Colorfastness (Light and Crocking).

## PART 2 - PRODUCTS

### 2.1 TEXTILE COMPOSITE FLOORING

- A. Finish Abbreviations: TCF-1.
  - 1. Products: Provide the following, or Architect-approved substitution.
    - a. Basis of Design: J+J Flooring Group, a Division of Engineered Floors: Kinetex.
  - 2. Approved Substitutions: Architect-approved equal products submitted as specified for substitutions.
  - 3. Product, Color, and Size:
    - a. Pattern: 1843 Urban Avenue
    - b. Color: As selected by Architect from full range of standard color options.
    - c. Size: 24 by 24 inches.
    - d. Installation: Brick.



## 2.2 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: Conform to ADA, ANSI A117.1, and requirements of authorities having jurisdiction.
- B. Flame and Smoke Resistance Standards: Conform to following standards or comparable standards, as accepted. Pill Test: Pass test for flammability, ASTM D2859 or DOC FF-1.
  - 1. Floor Radiant Panel Test (FRPT): Critical Radiant Flux of 0.45 watts/cm<sup>2</sup> (Class 1) or better, for burning under varying radiant energy levels, ASTM E648.
  - 2. NBS Smoke Density Chamber Test: Less than 450 for density of smoke generated in radiant heat chamber with and without flame, ASTM E662.
- C. VOC Content: Complying with limits of authorities having jurisdiction.

## 2.3 PERFORMANCE / DESIGN CRITERIA

- A. Provide textile composite flooring from same dye lot.
- B. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:
  - 1. Comply with Regulatory Requirements specified in this Section.
  - 2. Colorfastness:
    - a. To Light: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC 16E.
    - b. To Atmospheric Contaminants: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC 129 Ozone and AATCC Test Method 23.
  - 3. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.
  - 4. Noise Reduction Coefficient (ASTM C423): NRC Rating of 0.30.
  - 5. Impact Insulation Classification (ASTM E492): IIC Rating of 64.
  - 6. Slip Resistance: Complies with ADA Guidelines.
  - 7. Thermal Insulation (ASTM C518): R-4.
  - 8. Static Control: AATCC 134, static generation below 3.0 kV at 20 percent Relative Humidity and 70 degrees F using anti-static filaments without chemical treatment.
  - 9. Indoor Environmental Quality: CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus Test.

## 2.4 TEXTILE COMPOSITE FLOORING MATERIALS

- A. Modular Textile Composite Flooring:
  - 1. Backing: Polyester Felt Cushion.
  - 2. Dye Method: Solution Dyed.
  - 3. Wear Layer: Universal Fibers Polyester.
  - 4. Total Thickness: .205 inches.
  - 5. Total Weight (Nominal Average): 4.5 oz - 5.2 oz / square foot.
  - 6. Pattern Repeat: N/A.
  - 7. Soil Release: Yes.
  - 8. Comply with Warranty, Regulatory, and Performance / Design Criteria specified in this Section.
  - 9. NSF/ANSI 140 Platinum Certified.

- B. Carpet Adhesive/Primer:
  - 1. Low VOC: As instructed by carpet manufacturer.
  - 2. Fully adhered, water-resistant, and non-staining.
  - 3. Conform to flammability requirements for installed carpet.
  - 4. Kinetex Adhesive, an aggressive, pressure-sensitive adhesive designed for the installation of Kinetex textile composite flooring modules is required.
  - 5. Kinetex PreFix, a quick installation for all Kinetex textile composite flooring products. The release liner easily peels away to reveal a series of pre-applied adhesive strips that securely anchor the Kinetex module in place, (PreFix Primer is required).

## 2.5 AUXILIARY MATERIALS

- A. Patching Underlayment: Polymer modified Portland-cement-based underlayment.
- B. Latex Adhesive Residue Encapsulating Sealer: APAC ENCapSeal (use only after majority of adhesive is removed and is acceptable to flooring manufacturer).
- C. Carpet Adhesive Residue Encapsulating Sealer: TriSeal Sealer (use only after majority of adhesive is removed and is acceptable to flooring manufacturer).
- D. Alkalinity Sealer: Commercial on Premium Sealer (depending on pH Readings as specified in Part 3 of this Section).
- E. Transition Strips:
  - 1. Kinetex requires protective transition of 3/16-inch to other floor covering thickness. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.
- F. Miscellaneous Materials: Conforming to carpet manufacturer's instructions and as required for complete and finished installation.

## 2.6 EQUIPMENT

- A. Vacuum Cleaner: DOE-STD-3020, High Efficiency Particulate Air (HEPA) filter vacuum cleaner machine with high airflow (suction), face-beater element with adjustable brushes, 99.97 percent filtration efficiency at 0.3 micron particle size, bearing CRI Vacuum Cleaner Indoor Air Quality (IAQ) Testing Program green label.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify conditions are ready to receive work of this Section before beginning. Notify Architect of conditions that are not acceptable. Starting preparation and installation constitutes acceptance of conditions.
  - 1. Verify substrate free of debris, deposits, oil, dirt, dust, paint, curing compounds, waxes, surface moisture, and other bond breaking conditions that may affect adhesion.
  - 2. Verify substrate free of ridges, bumps, and depressions that may telegraph through carpet.
  - 3. Verify that required floor-mounted utilities are in correct location.
  - 4. Inspect flooring materials prior to installation, as specified in Field Conditions in Part 1 of this Section.
- B. Subfloor Conditions:
  - 1. Old Concrete - Old concrete must be checked for moisture. Dry, dusty, porous floors must be primed or encapsulated with APAC ENCapSeal. Note: Primers will not correct a moisture problem.

2. Carpet - Remove old carpet and carpet adhesives by scraping or other mechanical means. Any remaining adhesive residues may be covered with a Portland based patching compound or encapsulated with TriSeal Sealer.

### 3.2 PREPARATION

- A. Conform to ASTM F710 and manufacturer's written instructions for preparing concrete floors to receive resilient flooring. Comply with flooring manufacturer's requirements to receive system warranty.
- B. Remove dust, dirt, debris, and non-compatible adhesives, and clean floor in conformance to manufacturer's written instructions.
  1. **Kinetex Adhesive cannot be applied to any substrate where chemical or solvent-based cleaners have been used.**
- C. Repair subfloor ridges and bumps.
  1. Fill cracks over 1/16 inch wide with latex based underlayment.
  2. Fill minor holes and cracks over 1/8 inch thick with polymer-modified cementitious patching underlayment.
  3. Fill depressions and low spots where floor is not level using cementitious underlayment specified approved by finish flooring manufacturer.
  4. Grind ridges or rough areas that may telegraph through flooring.
- D. Feather substrate with cementitious underlayment or do such work as necessary for carpet-to-carpet transition alignment at top surface.
- E. Clear debris and deposits from surfaces. Remove adhesives and contaminants from existing concrete floors. Vacuum substrate immediately prior to carpet installation.
  1. Old latex adhesives must be mechanically scraped down to a bare residue. Latex adhesive residues must be smooth and level with all holes and cracks filled with patching underlayment or encapsulating sealer specified in this Section.
  2. Cut-back adhesives must be wet mechanically scraped to a minimum residue and sealed with encapsulating sealer.
- F. Apply primer and sealers as instructed by manufacturer to seal concrete surface and make suitable for textile composite flooring adhesion.

### 3.3 INSTALLATION

- A. Conform to manufacturer's instructions, CRI Carpet Installation Standard 2011, and provisions of Contract Documents. Comply with flooring manufacturer's requirements to receive system warranty.
- B. Adhesive System: Kinetex PreFix pre-applied adhesive for all Kinetex flooring modules.
  1. PreFix Pre-Applied Adhesive:
    - a. PreFix Primer Application: Primer is not optional. Read all installation instructions thoroughly.
      - 1) Pour the diluted primer onto the substrate and roll on using 3/8-inch nap or foam roller. Do not puddle. Additional coats may be required upon visual inspection over extremely porous concrete.
      - 2) Allow the material to dry to the touch. Lower substrate temperatures and/ or higher humid conditions could extend the drying time.
    - b. Installing PreFix Kinetex Modules:
      - 1) After the PreFix primer has dried, begin the installation at the intersection of the central module anchor lines. Peel off the release film. Complete the installation one

quarter area at a time laying the modules firmly and accurately along the anchor lines. Follow approved installation method(s) for each specific product.

- C. Module Placement: Arrows are printed on the module backing to show pile/machine direction. A tight installation without compression is mandatory for optimum performance and appearance of the modular installation. It is critical that each module uniformly touch each adjoining module without a gap. To ensure a clean tight fit, do not pull/tug or slid-in modules, but instead lay each module into its location against the adjoining module. Use your hands to press/form the module into place where the new module meets
- D. meets the previous
- E. ly installed module. See specific product specifications for approved installation method(s).
- F. To reposition a Kinetex module during installation, remove it by gently lifting all four sides of the module with a spatula or putty knife, rotating around each side of the module doing a little at a time. The very center of the module should be the last part of the module touching the floor upon removal. Do not stretch a module while it is in the adhesive in order to align next to an adjoining modular. An attempt to stretch will likely result in the module pulling back to its original position.
  - 1. Never attempt to remove a module all at once by pulling one or only two sides of the modular. Doing so may lead to distorting the module.
- G. Pallet And Bundle Sequencing: It is very important to install Kinetex modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle of modules. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. Refer to flooring manufacturer's written instructions for layout and installation.
- H. Completing Installation: To avoid dislodging modules, do not walk on or move furniture onto modules until the area is completely anchored. Roll entire area with 75-100 lb. roller in both directions (north-south and east-west) after completion of installation.

### 3.4 LAYOUT AND FITTING

- A. Install textile composite flooring from same dye lot within each continuous floor area. Remove and replace textile composite flooring within continuous areas differing in appearance.
- B. Lay out and fit to maintain pattern, texture, and direction of pile within each floor area prior to installation.
- C. Extend textile composite flooring to cover complete flooring area of each room, including alcoves and closets, unless otherwise indicated.
  - 1. Install under open-bottomed obstructions, removable flanges, and furnishings.
- D. Make cutouts and terminations as needed for complete and finished appearance.
- E. Measure area, snap chalk lines, and determine starting point for uniform layout of modules to reduce cutting and eliminate piece less than 1/4 size of full module width where possible.
- F. Cut textile composite flooring evenly and accurately to fit neatly at walls, columns, and projections.
- G. Cut and join textile composite flooring ends in serpentine pattern as necessary to conceal pattern.
- H. Do not bridge building expansion joints with continuous flooring.

### 3.5 ACCESSORIES INSTALLATION

- A. Install accessories as required by Contract Documents and manufacturer's written instructions. Install reducer strips at textile composite flooring edges transitioning to hard flooring surfaces.

### 3.6 FIELD QUALITY CONTROL

- A. Manufacturer Services:
  - 1. Participate in Project start-up.
  - 2. Promptly notify Owner, Architect, General Contractor, or another designated contact if manufacturer's installation instructions are not followed.
  - 3. Submit field quality control reports.
- B. Concrete Slabs Receiving Resilient Flooring Systems: Perform testing by independent inspection agency accepted by Architect to verify concrete substrate moisture content and pH level as suitable prior to installing resilient flooring system installations, conforming to manufacturer's Warranty provisions.
  - 1. Testing Conditions: Do not conduct field quality control testing until:
    - a. Building envelope is enclosed and weathertight.
    - b. Interior ambient temperature and relative humidity are equivalent to that expected during occupancy by Owner.
  - 2. Relative Humidity (RH) Testing: Test to ASTM F2170 to determine relative humidity (RH) within center of concrete floor slabs using in-situ probes.
    - a. Acceptable relative humidity probe testing results are up to 95 percent RH when using Kinetex Adhesive and up 99 percent RH when using Kinetex PreFix.
- C. Alkalinity of Concrete Substrate: Test to ASTM F710. Verify maximum pH factor at substrate surface to receive adhesives for resilient floor finishes and as acceptable to manufacturer.
  - 1. The maximum acceptable pH is 10.0 when using Kinetex Adhesive and 11.0 when using Kinetex PreFix.
  - 2. For pH Readings of 9.0 to 11.0: Apply Commercial on Premium Sealer.
- D. Notify Architect and Owner in the event of field quality control test results outside of acceptable range.

### 3.7 ADJUSTING

- A. Remove mismatched, non-uniform, and damaged textile composite flooring and replace with new modules matching adjacent modules.
- B. Remove spots, soiling, and stains or replace with new modules where textile composite flooring cannot be put back into new condition.
- C. Remove protruding face yarn using sharp scissors.

### 3.8 CLEANING

- A. Remove and dispose of debris and unusable scraps.
- B. Vacuum textile composite flooring using an upright, HEPA filter vacuum cleaner. Replace and dispose of vacuum bags when bag is half full.
- C. Remove contaminants such as adhesive, paint, oil and grease. Use a moist cloth when wet; if dry, use a solvent-based product applied to a towel then worked onto the textile composite flooring module. Follow flooring manufacturer's maintenance guidelines.

### 3.9 PROTECTION

- A. Take measures to protect carpet from soiling and damage prior to Owner occupation. Place sheets of plywood or hardboard over installed textile composite flooring prior to transporting heavy furniture on carts or dollies.

END OF SECTION 096814

## SECTION 097200 – DIGITAL WALL COVERINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Custom Designed Vinyl Graphic Wall Coverings.

#### 1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
2. Show all custom graphic images to be printed for Owner approval.

- ##### B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.

- ##### C. Generic Material Samples: For each type of vinyl graphics and window film and for each color, pattern, texture, and finish specified, a minimum size of 6 by 6 inches.

1. Project Specific Vinyl Strike-off sample: From same production run to be used for the Work, with exact ink type and specified treatments applied. Show partial print of image to be installed a full scale on a sample piece no less than 12 by 12 inches. Mark top and face of vinyl.

- ##### D. Product Schedule: For custom printed vinyl window film and graphics. Use same designations indicated on Drawings.

##### E. Mockups required:

1. One single 3 by 3 square foot wall graphic panel for Owner review and approval.

#### 1.4 INFORMATIONAL SUBMITTALS

- ##### A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Obtain all products in this section from a single Manufacturer with a minimum of 10 years' experience.
- B. Product Test Reports: For each vinyl window film and graphic film, for tests performed by a qualified testing agency.
- C. Installation: Installation shall be performed by a trained and qualified installer, specialized and experienced in the work required for this project.

## 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.

## 1.7 FIELD CONDITIONS

- A. Confirm existing substrates are suitable for mounting of glass finish components and vinyl wall components prior to the start of installation.
- B. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.
- C. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- D. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

## 1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.
- C. Product must remain in original plastic bag and boxes and have storage conditions as follows:
  - 1. 40 °F – 90 °F (4 °C - 32 °C).
  - 2. Out of direct sunlight.
  - 3. Clean dry area.
  - 4. Original container.
  - 5. Handle products in accordance with manufacturer's instructions.
  - 6. Do not stack boxes over six (6) units high. Excessive weight can damage the film.



7. Shelf Life: 2 years under ordinary conditions at a temperature of 72°F (22°C) and relative humidity of 50-55%.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.

### 2.2 CUSTOM DIGITAL GRAPHIC VINYL WALL AND WINDOW COVERINGS (DWC)

- A. Basis of Design Product Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Basis of Design: 3M.
  2. Contra Vision North America, Inc.
  3. Solvex.
  4. Architect approved equal.
- B. Graphic Designer Provided Design Process:
  1. Manufacturer: A manufacturer capable of designing, fabricating and installing vinyl wall graphics that meet or exceed performance requirements indicated. At least (5) years experience with systems of the specified types and products included.
    - a. **Basis of Design, Graphic Designer, Manufacturer and Installer: Streamline Designs., 3475 Niagara Fls Blvd, North Tonawanda, NY 14120.**
    - b. Ninja Graphics, Inc.
    - c. VSP Graphic Group.
    - d. Architect approved equal
  2. Manufacturer to provide designs for vinyl wall graphics as indicated in contract documents.
    - a. Size: Refer to the drawings.
    - b. Locations & Quantities: Where shown on the drawings.
    - c. Design:
      - 1) Generated by Manufacturer's Graphic Designer.
        - a) Design Intent: District school spirit-themed vinyl wall graphics.
      - 2) Manufacturer to meet with owner a total of (2) times.

- a) Meeting #1: Project kick-off and initial information gathering. Presentation of the first round of design concepts by the graphic designer.
- b) Meeting #2: Make revisions from prior meeting as directed by Owner. Final sign-off of all graphic designs.

C. Graphic Film – Cast Vinyl

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. **Basis of Design: 3M Controltac Graphic Film, Series 180, with Comply V3 Adhesive (IJ180CV3)**
  - b. Architect approved equal.
- 2. Description: Provide 2 mil cast vinyl film, complying with the following:
  - a. Thickness: 2 mil cast vinyl, 4 mil with adhesive.
  - b. Adhesive: Pressure-activated.
  - c. Tensile Strength: 5 pounds/inch at 73 deg. F
  - d. Screen Printed with design generated by manufacturer and approved by owner.
  - e. Total ink coverage.
  - f. Flamability: ASTM E84.
  - g. Warranty: 5 years.
  - h. Application: Interior, comply with manufacturer's required installation methods.

2.3 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
- B. Primer/Sealer: Mildew resistant, complying with requirements in and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. **The General Trades Contractor shall providing a double skim coat, and repair of any visible damage to the existing gypsum or plaster walls at all locations receiving custom vinyl graphics.**
  - 1. **It is the wall covering manufacturer's responsibility to provide written notification of any substrate conditions that are unacceptable prior to the start of work.**
  - 2. **Commencement of work indicates acceptance and approval of the wall substrates.**

- C. **Proceed with installation only after unsatisfactory conditions have been corrected.**

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  - 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 3. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

### 3.3 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- F. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- G. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

- H. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
  - 1. Unless noted otherwise, install vinyl graphic wall coverings over top of these existing equipment items on all mural walls without impairing their function. Wrap the items before reinstalling them.
    - a. Electrical Outlet cover plates.
    - b. Light Switch cover plates.
    - c. Cabinet Unit Heater cover plates.
    - d. Blank cover plates.
  - 2. Existing grilles on graphic walls that can't be wrapped shall be painted.
  - 3. Do not vinyl wrap fire extinguisher cabinets, exit signs, FEC location stickers, or other miscellaneous fire alarm equipment.

#### 3.4 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

## SECTION 098433 - SOUND-ABSORBING WALL UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

- 1. Sound-absorbing wall units, custom-fabricated (SAW).

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include panel color, panel edge, core material, and mounting indicated.

- B. Shop Drawings: For unit assembly and installation.

- 1. Include plans, elevations, sections, and mounting devices and details.
  - 2. Include details at panel head, base, joints, and corners, and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
  - 3. Include details at cutouts and penetrations for other work.
  - 4. Include direction of fabric and pattern matching.

- C. Samples for Initial Selection: For each type of panel color.

- 1. Include Samples of hardware and accessories involving color, finish and texture selection.

- D. Color Chart: Illustrating manufacturer's full range of colors and patterns.

- E. Samples for Verification: For the following products:

- 1. Panel Color: 12-inch square sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of panel.
  - 2. Panel Edge: 12-inch long Sample(s) showing each edge profile, corner, and finish.
  - 3. Core Material: 12-inch square Sample at corner.
  - 4. Mounting Devices: Full-size Samples.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

- 1. Electrical outlets, switches, and thermostats.

2. Items penetrating or covered by units including the following wall equipment:
  - a. Air outlets and inlets.
- B. Product Certificates: For each type of unit.
- C. 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.
- D. Sample Warranty: For manufacturer's special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to be included in maintenance manuals. Include unit manufacturers' written cleaning and stain-removal instructions.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.
- C. Temperature
  1. Stabilize relative humidity at 35% Minimum RH and 55% Maximum RH.
  2. Maintain surface and ambient temperatures above 55 degrees F, unless required otherwise by manufacturers instructions.
  3. Do not apply adhesive when substrate surface temperature or ambient temperature is below 55 degrees F.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to the following:

- a. Defective original material or workmanship
- 2. Warranty Period:
  - a. Two years from date of Purchase.
- 3. This warranty does not apply to components not manufactured by the Basis-of-Design manufacturer, 'Hush Acoustics'.
  - a. In the instance of goods sold by 'Hush Acoustics' that have been produced by another manufacturer, 'Hush Acoustics' passes on the said manufacturer's warranty to the purchaser.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

### 2.3 PET ACOUSTIC FELT SOUND ABSORBING WALL UNITS (SAW-1)

- A. **Basis of Design:** Subject to compliance with requirements, **provide: Hush Acoustics USA;** or comparable product by one of the following manufacturers:
  - 1. Manufacturers:
    - a. Turf Design.
    - b. MDC Interior Solutions.
    - c. Architect approved equal.
- B. Acoustic Wall Panel:
  - 1. Material: 100% PET felt (Polyethylene Terephthalate); 60% recycled material
  - 2. Thickness: 12mm (0.5 in)
  - 3. Size: Custom designs, refer to drawings for additional details and cut-out sizes.

4. Edge Detail: Square.
5. Sound Absorption (ASTM C423): Noise Reduction Coefficient: 0.4
6. Fire Rating: (ASTM-E84) Class A.
7. Fungal Resistance: (ASTM-C1338 laboratory conditions) zero mold growth.
8. Mounting: Adhesive, Refer to manufacturer's written instructions and installation information.
9. Panel Color: custom printed on a white core using a Pantone® Uncoated color palette
  - a. Color as selected by Architect from manufacturer's full range of options.
10. Refer to Drawings for installation pattern and color indications.
11. Manufacturer's Warranty: 2-Year Limited Warranty.

## 2.4 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core and with rigid edges to reinforce panel perimeter against warpage and damage.
  1. Square corners.
- B. Panel Cutting: panels are to be cut in the factory prior to delivery per coordination with Contractors field verifications and approved shop drawings.
- C. Panel Identification: Panels are to be identified during shop production prior to shipping with the panel name/number for the Contractor to identify panel locations according to the construction documents.
- D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
  1. Thickness.
  2. Edge Straightness.
  3. Overall length and width.
  4. Squareness from corner to corner.
  5. Chords, radii, and diameters.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
  1. Do not install panels until unsatisfactory conditions are corrected.
  2. Verify that stud spacing is 16 inches O.C. maximum, for panels installed over open studs.



### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

### 3.3 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions, including product technical bulletins, product catalog installation instructions and product carton instructions for installation of units.

### 3.4 CLEANING

- A. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions. Replace panels that cannot be cleaned to as new condition.
- B. Keep site free from accumulation of waste and debris.

END OF SECTION 098433

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Galvanized Metal.
  - 2. Steel and Iron.
  - 3. Gypsum board.
  - 4. Plaster.
  - 5. Wood.
  - 6. Concrete Masonry Units (CMUs).

#### 1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523. (Matte/Flat Finish)
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523. (Velvet Finish)
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523. (Eggshell Finish)
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523. (Satin Finish)
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523. (Semi-gloss Finish)
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523. (Gloss Finish)
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523. (High Gloss Finish)

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
  - 2. Coating Maintenance Manual: Upon Conclusion of the project, the Contractor or paint supplier/manufacturer shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch up procedures, and color samples of each color and finish used.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. **Basis of Design Product:** Subject to compliance with requirements, provide **The Sherwin-Williams Company** or an approved equivalent from one of the following:
  - 1. Benjamin Moore & Co.
  - 2. PPG Architectural Coatings.
  - 3. Glidden Professional, a Division of PPG Architectural Coatings, Inc.
  - 4. Architect Approved Equal.

- B. Products: Subject to compliance with requirements, listed in the Interior Painting Schedule for the paint category indicated.

## 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Fiber-Cement Board: 12 percent.
  - 3. Masonry (Clay and CMUs): 12 percent.
  - 4. Wood: 15 percent.
  - 5. Gypsum Board: 12 percent.
  - 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
  - 1. At the existing concrete ramp supports, scuff sand the entire surface before painting.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
  - 1. SSPC-SP 3.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Existing Door Frames: Remove ALL layers of paint using manufacturer's recommendation for mechanical removal and/or solvent removal.
- I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- J. Aluminum Substrates: Remove loose surface oxidation.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.
- L. Wood Substrates:
  - 1. Scrape and clean knots and apply coat of knot sealer before applying primer.
  - 2. Scuff sand surfaces that will be exposed to view, and dust off. Including all faces and edges of doors to create a profile.

3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work unless prohibited by code or direction in trade-specific specification sections:
  1. Paint the following work where exposed in occupied spaces:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - g. Other items as directed by Architect.
      - 1) Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
  - 1. Latex System:
    - a. Block Filler: Block filler, latex, interior/exterior, MPI #4 X-Green:
      - 1) S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal (2.4 to 4.9 sq. m per l).
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, eggshell, (Gloss Level 3):
      - 1) Topcoat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20W12651, at 4.0 mils wet, 1.1 mils dry.
- B. Metal Substrates (Aluminum, Galvanized Steel):
  - 1. Latex System:
    - a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107:
      - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
    - b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
    - c. Topcoat: Water-based acrylic, semi-gloss, (Gloss Level 5), MPI #147 X-Green:
      - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
  - 2. Water-Based Dry-Fall System:

- a. Top Coat: Dry-fall latex, flat, MPI #118:
      - 1) S-W Pro Industrial Waterborne Acrylic Dry-fall Flat, B42-80 Series, at 6.0 mils wet, 1.7 mils dry.
  - 3. Tube Steel: (Elementary Vestibule V9)
    - a. Powder coating Prime Coat: Primer, rust-inhibitive, UV Resistant:
      - 1) Powdura Super Durable Primer (RAS5-80000)
    - b. Powder coating Intermediate Coat (if required): Powder coating with mica pigments, Matching topcoat.
    - c. Powder Coating Topcoat: Powdura 4000 Anodite Coatings:
      - 1) Ultra matte, smooth finish.
- C. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
  - 1. Latex System:
    - a. Prime Coat: Primer sealer, latex, interior, MPI #39:
      - 1) S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, eggshell, (Gloss Level 3), MPI #52 X-Green/#145 X-Green:
    - d. Topcoat: Latex, interior, semi-gloss, (Gloss Level 4), MPI #43 X-Green:
      - 1) S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
  - 2. Acrylic/Alkyd System:
    - a. Prime Coat: Primer sealer, latex, interior: S-W Premium Wall & Wood Primer, B28W8111, at 4.0 mils wet, 1.8 mils dry.
    - b. Intermediate Coat: Urethane alkyd, interior, matching topcoat.
    - c. Topcoat: Water-based acrylic-alkyd, semi-gloss, interior:
      - 1) S-W Pro Industrial Urethane Alkyd Enamel, B54-150 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
- D. Gypsum Board, Plaster and Spray-Texture Ceiling Substrates:
  - 1. Latex System:
    - a. Prime Coat: Primer, latex, interior, MPI #149 X-Green:
      - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Ceilings: Topcoat: Latex, interior, low sheen, (Gloss Level 2).
      - 1) Topcoat: S-W ProMar 200 Zero VOC Latex Flat, B30W12651, at 4.0 mils wet, 1.4 mils dry.
    - d. Walls: Topcoat: Latex, interior, eggshell, (Gloss Level 3):
      - 1) Topcoat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20W12651, at 4.0 mils wet, 1.1 mils dry.
- E. Water-Based Light Industrial Coating System:
  - 1. Latex System:
    - a. Prime Coat/Block Filler: Block filler, latex, interior/exterior, MPI #4 X-Green:
      - 1) S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal (2.4 to 4.9 sq. m per l).



- c. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
- e. Topcoat: Light industrial coating, interior, water based, eggshell, (Gloss Level 3), MPI #151:
  - 1) S-W Pro Industrial Pre-Catalyzed Water-based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

F. Steel Substrates (including new and existing door frames):

- 1. High-Performance Architectural Latex System MPI INT 5.1R:
  - a. Prime Coat Primer, alkyd, anti-corrosive, for metal, MPI #79
  - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
  - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

END OF SECTION 099123

## SECTION 101100 - VISUAL DISPLAY UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Visual display board assemblies.
  - a. Tack-board
2. Sliding visual display units.
3. High Pressure Laminate Faced Shelving.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

##### B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work. Include details of wall mounted shelving and brackets behind sliding visual display boards
2. Show locations of panel joints.
3. Include sections of typical trim members.

##### C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.
2. Swatches of facings for tack-boards.
3. Actual factory-finish color samples applied to aluminum substrate.
4. Include accessory Samples to verify color selected.

##### D. Samples for Verification: For each type of visual display unit product indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-long sections of each trim profile.
3. Display Rail: 6-inch-long section of each type.
4. Rail Support System: 6-inch-long sections.
5. Backdrops: 2 samples, minimum size 6 inches square, representing actual product, color, and patterns
6. Accessories: Full-size Sample of each type of accessory.
  - a. Plastic Laminates: Color chart only. Architects have physical samples of high pressure laminates in house.
  - b. PVC Edge material.

- c. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.
- E. Product Schedule: For visual display units. Use same designations indicated on Drawings.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each visual display unit, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Sample Warranties: For manufacturer's special warranties.

### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display units to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturers.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.
- B. Store products in manufacturers unopened packaging until ready for installation.
- C. Protect products from damage during delivery, handling, storage, and installation.

### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### 1.8 COORDINATION

- A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

## 1.9 WARRANTY

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
  1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.

### 2.2 VISUAL DISPLAY BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  1. Claridge Products and Equipment, Inc. (Basis of Design)
  2. ASI Visual Display Products
  3. Architect approved equal.
- B. Visual Display Board Assembly: factory fabricated.
  1. Assembly: Markerboard
  2. Corners: Square.
  3. Width: As indicated on Drawings.
  4. Height: As indicated on Drawings.
  5. Mounting Method: Direct to wall.
- C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
  1. Color: As selected by Architect from full range of industry colors.
- D. Aluminum Frames and Trim:
  1. Frameless fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
  2. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
  3. Aluminum Finish: Clear anodic finish.
- E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
- F. Combination Assemblies: Provide hidden spline between abutting sections of visual display panels.

- G. Chalk tray: Manufacturer's standard; continuous.
  - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- H. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, and continuous paper holder, designed to hold accessories.
  - 1. Size: 1 inch1-inch full length of visual display unit.
  - 2. Map Hooks: Two map hooks for every 48 inches of display rail or fraction thereof.
  - 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
  - 4. Tack-board Insert Color: As selected by Architect from full range of industry colors.
  - 5. Aluminum Color: Match finish of visual display assembly trim.

## 2.3 SLIDING VISUAL DISPLAY UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. **Claridge Products and Equipment, Inc. (Basis of Design)**
  - 2. Platinum Visual Solutions.
  - 3. Architect Approved Equal.
- B. Horizontal-Sliding Wall System: Factory-fabricated units consisting of extruded-aluminum tubular frame, fixed rear visual display panel, aluminum-framed horizontal-sliding visual display panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
  - 1. Sevent Track Units: Provide seven equal sliding panels.
  - 2. Hardware: Manufacturer's standard, extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.
  - 3. Overall Width: As indicated on Drawings. Verify in field.
  - 4. Overall Height: As indicated on Drawings. Verify in field.
- C. Panels and Accessories:
  - 1. Sliding LCS Porcelain enamel steel markerboard writing surface.
    - a. Color: White.
- D. Aluminum Trim: Factory applied, in manufacturer's standard size and profile; with clear anodic finish.

## 2.4 MATERIALS

- A. LCS Porcelain Steel: 100% noncombustible surface, gives off no toxic gases, 99.9% recyclable, third-party indoor air quantity certified (SCS Indoor Advantage Certified). Magnetic and projection friendly, life of the building guarantee.
- B. Fabric: ASTM E84 Class A/Class 1, 100% IFR Xorel, approved for use as a tackable surface, 10 year warranty.
- C. Extruded Aluminum: ASTM B 221, Alloy 6063.

- D. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application as recommended in writing by visual display unit manufacturer.
- E. Primer/Sealer: Mildew-resistant primer/sealer complying as recommended in writing by visual display unit manufacturer for intended substrate.

## 2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

## 2.7 HIGH PRESSURE LAMINATE FACED SHELVING

- A. High-Pressure Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC ; High Pressure Laminate and/or a comparable product by one of the following:
    - a. Formica Corporation.
    - b. Laminart.
    - c. Nevamar.
    - d. Pionite.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As selected by Architect from laminate manufacturer's full range inclusive of basis of design's (Wilsonart) styles and laminate for standard 38, 60 and 28 surface textures.
  - 2. Specialty premium surface textures, high-definition wood grains, etc. or equivalent from other manufacturers verified through sample submittals.
- C. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS.
  - 2. Edges: PVC edge banding, 3mm thick, matching laminate in color, pattern, and finish.

- D. Grain Direction for Wood Grain Plastic Laminate:
  - 1. Side to side on horizontal shelving.
  
- E. 3mm thick PVC Edge Banding: Solid, high impact, purified, color thru, acid resistant, pre-lamination primed edging, machine applied with hot melt adhesives, automatically trimmed, inside/outside length radiused for uniform appearance, buffed and corner radiused for consistent design. Colors shall be selected from manufacturer's full range. Minimum of one different color for each laminate color.
  - 1. Basis of Design Product: Wilsonart PVC Edgeband or Architect approved equal.
    - a. Colors: TBD. Allow for a minimum of one color for each laminate selection.
  
- F. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
  - 1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
  - 2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.
  
- G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112. Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, for nominal 1 inch spacing.
  - 1. Basis of Design Product: KV Series 82 Heavy- Duty Standards and 182 Series Heavy-Duty Brackets
    - a. Powder- coat finish.
    - b. 16-gauge steel brackets, 14-gauge steel standards.
    - c. Adjustable on 1-inch centers.
    - d. Height: As indicated in Drawings.
    - e. Shelf Standard Spacing: As recommended by the Manufacturer, not more than 24 inches on center.
  
- H. MARKER TRAYS
  - 1. Universal Marker Holder: Basis-of-Design Ghent Model # ASB-M4-AFE
  - 2. Marker holder, min. size 4" x 3" x 1-3/4" D
  - 3. Capable of holding four markers minimum and one eraser.
  - 4. Attached to wall via embedded magnets or adhesives.
  - 5. Provide one total holder for the sliding display unit.
  - 6. Mounting Height: 36 inches above finished floor to top of metal unit.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prepare recesses for sliding visual display units as required by type and size of unit.

### 3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
  - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as indicated on approved Shop Drawings.
  - 2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.



- C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
- E. Sliding Visual Display Units: Install units at mounting heights indicated. Attach to wall framing with fasteners at not more than 16 inches o.c.
  - 1. Adjust panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- F. Install wood blocking within all partitions to receive shelf standards. Refer to section 061053 – Miscellaneous Rough Carpentry.

#### 3.4 CLEANING AND PROTECTION

- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 1100

## SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures entrance screens.

#### 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 toilet compartments.

##### B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of centerlines of toilet fixtures.
3. Show locations of floor drains.

##### C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

#### 1.3 CLOSEOUT SUBMITTALS

##### A. Maintenance Data: For toilet compartments to include in maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

##### A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents and source.

1. Door Hinges: Six hinges with associated fasteners.
2. Latch and Keeper: Four latches and keepers with associated fasteners.
3. Door Bumper: Six bumpers with associated fasteners.
4. Door Pull: Four door pulls with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

## 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

## 1.6 WARRANTY

- A. Manufacturer's Warranty
  - 1. Warranty Period: 25 years from date of Substantial Completion against breakage, corrosion, and delamination under normal conditions.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 200 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

### 2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- 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. Basis of Design: Hiny Hiders by Scranton Products.
  - 2. Ampco Products, LLC.
  - 3. General Partitions Mfg. Corp.
  - 4. Architect approved equal
- B. Toilet-Enclosure Style: Floor mounted, overhead braced
- C. Entrance-Screen Style: Floor anchored.
- D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
  - 1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.
  - 1. Polymer Color and Pattern: Matching pilaster.

F. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

## 2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's integral hinge from door and pilaster material with exposed metal parts on interior of stall, that swings to a closed or partially open position, allowing emergency access by lifting door.
2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- C. Zamac: ASTM B 86, commercial zinc-alloy die castings.

## 2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
  - 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise

indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

### 3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

## SECTION 102600 - WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Corner guards.
  - a. Rigid Plastic.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include examples of joinery, corners, end caps, top caps.

#### INFORMATIONAL SUBMITTALS

D. Qualification Data: For qualified Installer.

E. Material Certificates: For each impact-resistant plastic material, from manufacturer.

F. Material Test Reports: For each impact-resistant material.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Covers: Full-size plastic covers of maximum length equal to percent of each type, color, and texture of cover installed, but no fewer than long units.
  - 2. Bed-Locator Covers: Full-size plastic covers equal to percent of each type, color, and texture of cover installed, but no fewer than units.
  - 3. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 8 foot long units.
  - 4. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."
- D. Revise subparagraph below to suit Project. 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
  - 2. Keep plastic materials out of direct sunlight.
  - 3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard covers in a horizontal position.



## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

### 2.2 MATERIALS

- A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded material, thickness as indicated.
- B. Impact Resistance: Provide wall protection components that have been tested in accordance with the applicable provisions of ASTM F476.
  - 1. Chemical and Stain Resistance: Tested according to ASTM D 543.
  - 2. Self-extinguishing when tested according to ASTM D 635.
  - 3. Flame-Spread Index: 25 or less.
  - 4. Smoke-Developed Index: 450 or less.
- C. Stainless steel sheet: ASTM A 240/A 240M.

### 2.3 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 .

## 2.4 CORNER GUARDS

- A. Surface-Mounted, Resilient, Plastic-Cover Corner Guards: Manufacturer's standard , PVC-free assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- degree turn to match wall condition.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Construction Specialties, Inc.
    - b. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
    - c. IPC Door and Wall Protection Systems; Division of Inpro Corporation.
  2. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; as follows:
    - a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
    - b. Height: 8 feet.
    - c. Color and Texture: As selected by Architect from manufacturer's full range.
  3. Continuous Retainer: One-piece extruded plastic.
  4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

## 2.5 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.

## 2.6 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.7 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

- C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.
  - 1. Provide anchoring devices and suitable locations to withstand imposed loads.
  - 2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
  - 3. Adjust end and top caps as required to ensure tight seams.
- D. Door-Frame Protectors: Install on both door jams.
- E. Fire Doors: Install protection according to the listing of each item.

#### 3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

## SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Public-use washroom accessories.

#### 1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 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.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

##### B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

#### 1.4 INFORMATIONAL SUBMITTALS

##### A. Sample Warranty: For manufacturer's special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

##### A. Maintenance Data: For accessories to include in maintenance manuals.

## 1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, visible silver spoilage defects.
  - 2. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. American Specialties, Inc.
    - b. Bradley Corporation.
    - c. Tubular Specialties Manufacturing, Inc.
    - d. Architect approved equal
  - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset
  - 3. Mounting: Partition or wall mounted, serving two adjacent toilet compartments
  - 4. Operation: Noncontrol delivery with standard spindle
  - 5. Capacity: Designed for 4-1/2- or 5-inch diameter tissue rolls.
  - 6. Material and Finish: Stainless steel, No. 4 finish (satin)
- C. Paper Towel (Roll) Dispenser:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. American Specialties, Inc.
    - b. Bradley Corporation.
    - c. Tubular Specialties Manufacturing, Inc.
    - d. Architect approved equal
  - 2. Description: Lever-actuated mechanism permitting controlled delivery of paper rolls in preset lengths per stroke.
  - 3. Mounting: Surface mounted
  - 4. Minimum Capacity: 8-inch wide, 800-foot-long roll
  - 5. Material and Finish: ABS plastic, gray
  - 6. Lockset: Tumbler type.

D. Liquid-Soap Dispenser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. American Specialties, Inc.
  - b. Bradley Corporation.
  - c. Tubular Specialties Manufacturing, Inc.
  - d. Architect approved equal
2. Description: Designed for dispensing soap in liquid or lotion lather form.
3. Mounting: Vertically oriented, surface mounted
4. Lockset: Tumbler type.
5. Refill Indicator: Window type.

E. Grab Bar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. American Specialties, Inc.
  - b. Bradley Corporation.
  - c. Tubular Specialties Manufacturing, Inc.
  - d. Architect approved equal
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings Straight, 36 inches long.

F. Sanitary-Napkin Disposal Unit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - a. American Specialties, Inc.
  - b. Bradley Corporation.
  - c. Tubular Specialties Manufacturing, Inc.
  - d. Architect approved equal
2. Mounting: Surface mounted
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.

- 5. Material and Finish: Stainless steel, No. 4 finish (satin)

## 2.2 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Equip units for concealed anchorage and with corrosion-resistant backing plates.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800



## SECTION 105100 – SOLID PLASTIC LOCKER BENCHES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Solid Plastic Locker Benches.

#### 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 each type of solid plastic bench.
- B. Shop Drawings: For solid plastic locker benches.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show bench trim and accessories.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of plastic bench colors available.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing solid plastic benches and hardware to include in maintenance manuals.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver solid plastic bench seats until spaces to receive them are clean, dry, and ready for their installation.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Bench components shall be stored flat until assembly. All finishes shall be protected from soiling and damage during handling.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of existing steel bases to be reused prior to fabricating the new solid plastic bench seats.

- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of existing steel bench bases to remain.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that the solid plastic benches can be supported and installed as indicated.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of solid plastic benches that fail in materials or workmanship, excluding finish, within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of hardware.
  - 2. Damage from deliberate destruction and vandalism is excluded.
  - 3. Warranty Period for Locker Benches: Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 15 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. (Labor not included in warranty.)

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain locker benches and accessories from single source from single manufacturer.

### 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 SOLID PLASTIC LOCKER BENCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basis of Design: Scranton Products Inc.
  - 2. Bradley Corporation.
  - 3. ASI Storage Solutions; ASI Group.
  - 4. Architect Approved Equivalent.
- B. Refer to Contract Drawings for all solid plastic bench locations and dimensions.
- C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
  - 1. Size: Bench tops shall be 1-1/4 inches thick with all edges rounded to a 1/4 inch radius. Standard bench top size is 11 inches wide by length not to exceed 96 inches for one single piece.
  - 2. Material: Sides, tops and bottoms of bench seats shall be made from high impact, high density, polyethylene (HDPE) formed under pressure into solid plastic components with homogenous natural color throughout.
    - a. Benches shall be constructed from High Density Polyethylene (HDPE) resins. Material shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments.
    - b. Plastic components shall resist deterioration and discoloration when subjected to any of the following: acetic acid 80%, acetone, ammonia 12%, ammonium phosphate, bleach 12%, borax, brine, caustic soda, chlorine water, citric acid, copper chloride, core oils, hydrochloric acid 40%, hydrogen peroxide 30%, isopropyl alcohol, lactic acid 25%, lime sulfur, nicotine, potassium bromide; soaps, sodium bicarbonate, trisodium phosphate, urea, urine and vinegar. (Testing in accordance with corrosion testing procedure established by the United States Plastic Corporation.)
  - 3. Color: As selected by Architect from full range of manufacturer's options.
- D. Fixed-Bench Steel Support Brackets: Heavy duty steel brackets with Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to wall.
- E. Pedestals: Secured to bench tops with stainless steel tamper resistant Torx head screws and secured to floor using lead expansion shields with 2 inch stainless steel Phillips head machine bolts.

## 2.4 FABRICATION

- A. Fabricate solid plastic locker benches square, rigid, without warp, and with faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
  - 1. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

## 2.5 ACCESSORIES

- A. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
  - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine walls and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install solid plastic benches level, plumb, and true; shim as required, using concealed shims.
- D. Equipment:
  - 1. Fixed Benches: Provide support brackets at intervals indicated on Contract Documents, uniformly spaced per manufacturer's recommendations. Securely fasten tops of brackets to undersides of bench tops, and anchor bases to wall with corrosion resistant fasteners.

## 3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware where required.

### 3.4 PROTECTION

- A. Protect solid plastic benches from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes or replace any solid plastic bench sections that cannot be restored to factory-finished appearance. Repaint any steel support brackets where finish has been damaged. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105100

## SECTION 115123 - LIBRARY SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Shelving.
  - 2. Accessories.

#### 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 library stack systems and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Show clear-aisle widths from face of units.
  - 3. Detail fabrication and installation of library stack systems, including methods of anchoring them to building structures at locations recommended by manufacturer.
- C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- D. Samples for Verification: For the following products, one of each, in manufacturer's standard sizes:
  - 1. End panels.
  - 2. Top panels.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For library stack systems to include in maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Shelf Units: Five percent of quantity installed for each size and type indicated, but no fewer than 10 units.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood shelving until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of library stack systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metal finishes and other materials beyond normal wear.
    - b. Cushion Warranty Period: Five years for manufacturers defects from date of Substantial Completion.
    - c. Shelving Warranty Period: Twenty years for manufacturers defects from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SHELVING

- A. Library Shelving: Shelving designed for library use, consisting of a plywood core with veneer faced end, top, and back panels. Shelving units below 48" high will have pins to support adjustable shelves.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. **Basis of Design: Hale Manufacturing, Saratoga Series**
    - b. Media Technologies
    - c. HLF Furniture
    - d. Architect approved equal.
- B. Bookmark Shelving:
  - 1. Bookmark Fixed Shelving
    - a. Starter/Adder Construction: Where shown on drawings, provide starter/adder style construction for units.
    - b. Anchorage: Install Bookcases using floor anchors, wall anchors in locations recommended by factory trained installation team.
  - 2. Bookmark Single-Faced Fixed Bookcase Starter (LS-1):

- a. Parts: Bookcase consists of Top, Back, Ends & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panels.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 72" High
    - 2) 37" Wide
    - 3) 12" Deep
3. Bookmark Single-Faced Fixed Bookcase Adder (LS-1A):
  - a. Parts: Bookcase consists of Top, Back, End & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panel.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 72" High
    - 2) 36" Wide
    - 3) 12" Deep
4. Bookmark Single-Faced Fixed Bookcase Starter (LS-2):
  - a. Parts: Bookcase consists of Top, Back, Ends & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panels.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 72" High
    - 2) 31" Wide
    - 3) 12" Deep
5. Bookmark Single-Faced Fixed Bookcase Adder (LS-2A):
  - a. Parts: Bookcase consists of Top, Back, End & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panel.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 72" High
    - 2) 30" Wide
    - 3) 12" Deep
6. Bookmark Single-Faced Fixed Bookcase Starter (LS-3):
  - a. Parts: Bookcase consists of Top, Back, Ends & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:



- 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panels.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 30" High
    - 2) 37" Wide
    - 3) 12" Deep
7. Bookmark Single-Faced Fixed Bookcase Adder (LS-3A):
- a. Parts: Bookcase consists of Top, Back, End & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panel.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 30" High
    - 2) 36" Wide
    - 3) 12" Deep
8. Bookmark Double-Faced Mobile Bookcase (LS-4):
- a. Parts: Bookcase consists of Top, Back, Ends & Intermediate Panels, Base Shelf, Mobile Toe Assembly with concealed nonlocking casters, Valance, and Shelves.
  - b. Bookmark Double-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panels.
    - 3) Wood Veneer all exposed faces.
  - c. Double-Faced Bookcase Dimension:
    - 1) 42" High
    - 2) 37" Wide
    - 3) 24" Deep
9. Bookmark Single-Faced Fixed Bookcase Adder (LS-4A):
- a. Parts: Bookcase consists of Top, Back, End & Intermediate Panels, Base Shelf, Toe Assembly, Valance, and Shelves.
  - b. Bookmark Single-Faced Bookcase Material:
    - 1) 1" thick Veneer faced shelving.
    - 2) Bookmark style end panel.
    - 3) Wood Veneer all exposed faces.
  - c. Single-Faced Bookcase Dimension:
    - 1) 42" High
    - 2) 30" Wide
    - 3) 12" Deep

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Vacuum finished floor and wet mop resilient flooring over which shelving is to be installed.
- B. Before installing shelving, condition materials to average prevailing humidity in installation areas for a minimum of 48 hours.

### 3.3 INSTALLATION

- A. Install library stack systems at locations indicated on Drawings and according to manufacturer's written instructions.
- B. Starter/Adder Units: Connect groups together with standard fasteners according to manufacturer's written instructions, using concealed fasteners where possible.
- C. Enclosure Panels: Install end panels with concealed fasteners.
- D. Level and plumb bookstack units to a tolerance of 1/8 inch in 96 inches.
- E. Filler Panels: Install corner and intermediate wall filler panels where indicated to fill gaps at abutting shelving units.
- F. Install type of shelves at locations indicated and at spacing indicated or, if not indicated, at equal spacing in each unit.

### 3.4 ANCHORAGE

- A. Bookstack Anchorage: Install bookstacks using floor anchors, wall anchors, or top bracing in locations recommended by manufacturer and as indicated on Shop Drawings.

### 3.5 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

- C. Protect installed products from damage during remainder of the construction period.

END OF SECTION 115123

## SECTION 116623 - NATATORIUM EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Swimming pool finishes.
  - 2. Swimming pool miscellaneous equipment.
  - 3. Swimming pool timing system and accessories.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Manufacturer's data:
  - 1. Complete materials list of all items proposed to be furnished and installed under this Section.
  - 2. Manufacturer's specifications and other data require to demonstrate compliance with the specified requirements.
  - 3. The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For natatorium equipment to include in operation and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications of Pool Contractor:
  - 1. The pool contractor must have had at least ten (10) years experience in the construction of the type of swimming pool herein specified and must list at least ten (10) pools of this type, which we have been constructed and which, have been constructed and which, upon investigation, would be found to be completed in a satisfactory manner and in operation at least three (3) years.

2. The Owner/Architect reserves the right to reject the pool contractor if in his opinion such contractor shall not be acceptable for this project.
3. The pool contractor shall certify that the plans and specifications have been reviewed and that his bid will conform thereto.
4. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
5. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for performance of the work of this section.

B. Codes:

1. All work in this division shall be according to applicable local, state and national codes and regulations.

C. Job Coordination:

1. All bidding contractors are cautioned to clearly understand the limits of responsibility of the pool contractor as detailed in these specifications in preparing their bids. Prior to work start by either the pool contractor or the other contractors, a meeting will be held at the job site to establish work limits, job schedules and a liaison among contractors and the architect to ensure a coordinated construction process.

## 1.6 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect materials of this section before, during and after installation and to protect installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to Owner.
- C. Deliver and Storage: Deliver all material to the job site in their original unopened containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturer's recommendations as approved by the Architect.

## 1.7 WARRANTY

- A. Standard Warranty: One year from the date of substantial completion contractual warranty for the project.
- B. Special Warranty: Manufacturer agrees to repair or replace components of pool equipment that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Manufacturer's standard warranty from date of Substantial Completion. For each individual component.

## PART 2 - PRODUCTS

### 2.1 POOL FINISHES

- A. Grouting Material:
  - 1. All grout and caulking between the M100 perimeter and an concrete or grout surface required in the installation of the system shall be performed by the pool contractor
  - 2. Floors and Wall: To provide an expansive grout with controlled setting time for pouring under and behind the pipeless perimeter, the following mix is recommended: Use a 1 to 4 grout mix with 1% Sika Interplast-N.
- B. Caulking Materials:
  - 1. Refer to specification section "079200 – JOINT SEALANTS" for caulking material product data, performance requirements, and installation requirements.

### 2.2 SWIMMING POOL MISCELLANEOUS EQUIPMENT

- A. Competitor Racing Lanes:
  - 1. Racing lane markers consists of individual float segments measuring 4-17/4" in vinyl plastic covered aircraft type stainless steel to form a continuous line. Racing lane marker lies shall be 25 yards in length with 15 feet at each end in solid color with alternating one (1) foot sections of navy and white in between. Paddock No. 4921 or equal. Nine (9) required. Provide two (2) storage reels on rollers for storage of the racing lines, Paddock No. 4950 or equal.
- B. Backstroke Marker Posts:
  - 1. Provide four (4) each 1.90" o.d. x .06" wall 7'-4" high backstroke marker posts constructed of type 316 stainless steel, Paddock No. 4905 or equal, complete with paddock No. 4815 or equal stanchion anchors with removable caps. Provide rope and backstroke and marker flags, Paddock No. 4906 or equal.

### 2.3 SWIMMING POOL TIMING SYSTEM AND ACCESSORIES

- A. General: Subject to compliance with requirements, products listed below are based upon Colorado Systems, A PlayCore Company. Provide listed products or equal approved products.
  - 1. Provide all products and components from (1) manufacturer. System components must create a comprehensive timing and scoring system.
  - 2. Coordinate all power and data requirements with other trades.
- B. Plate Mounted Starting Blocks:
  - 1. Fast Track Starting Platform is quickly and easily removable:
    - a. The platform shall be side mounted and has a 24" wide x 32" long stainless steel top.

- b. Flush with front edge of the platform is a backstroke starting bar. There are also two vertical backstroke grips made of stainless steel positioned 15" on center.
- c. Lane numbers will be visible from all four sides of the platform.
- d. Top of starting platform shall be equipped with side rails made from 1" O.D. stainless steel tube welded to 1/8" stainless steel.
- e. Mounted to side rails shall be a removable "wedge" made of 12 gauge stainless steel with a 45 degree incline on the surface facing forward to the pool. Front surface shall have a non-slip surface. The "wedge" will use spring loaded plunger pins to lock securely into place. Single mechanism will be used to retract both pins simultaneously with one hand for ease of adjustment. "Wedge" shall slide uninhibited along guide rails on sides of platform.
- f. Top of starting platform shall be with a non-slip surface.
- g. Colors and custom logos are available as options.
- h. Integral relay platform interfaced with timing systems. (timing systems by others)
- i. Integral LED light across front of block interfaced with starting systems. (starting systems by others)
- j. **Basis of Design:** 4912 Fast Track Starting Platform St. St. Type 316L

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify critical dimensions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 COORDINATION

- A. Use all means necessary to coordinate with other trades and to ensure that proper and adequate provisions is made in the work of other sections to accommodate installation of the work of this section.
- B. Delivery: Deliver all factory-built swimming pool equipment and accessories as complete units.

#### 3.3 DISCREPANCIES:

- A. In the event of discrepancy, immediately notify the Architect and Construction Manager. Do not proceed with installation in areas of discrepancy until all such discrepancies have been totally resolved.

#### 3.4 INSTALLATION:

- A. Final installation and location of all equipment and accessories shall be in accordance with manufacturer's instructions and as shown on drawings and be coordinated with all other trades

that interface with the work required under this section to ensure proper and adequate provisions in the work.

### 3.5 ADJUSTING

- A. Adjust movable components of pool equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.
- B. Adjust and test all equipment and systems to ensure full and safe operation of pumps, filtration systems, chemical supply systems, drainage systems, and timing and scoring systems.

### 3.6 OPERATORS MANUAL:

- A. Three instruction booklets shall be delivered to the Owner including operation and maintenance procedures required for the pool, timing systems and accessories. The booklets shall contain manufacturers manuals on all major items and shall be supplemented with full operational sequences of all items in the system working together.

END OF SECTION 116623



## SECTION 122413 - ROLLER WINDOW SHADES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Motor-operated roller shades with single rollers.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of roller shade.
  - 1. Shadeband Material: Not less than 3 inches square. Mark interior face of material if applicable.
- D. Product Schedule: For roller shades.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

### 2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES (RWS-1)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. **Basis of Design: Draper Industries, Motorized FlexShade AC Roller Shade.**
  - 2. Hunter Douglas Contract.
  - 3. Lutron Electronics Co., Inc.
  - 4. Architect approved equal.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
  - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Electric Motor: Manufacturer's Quiet tubular, enclosed in roller.
    - a. Electrical Characteristics: 120-V ac
    - b. Maximum Total Shade Width: As required to operate roller shades indicated
    - c. Maximum Shade Drop: As required to operate roller shades indicated
    - d. Maximum Weight Capacity: As required to operate roller shades indicated
  - 3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for surface mounting.
    - a. Individual Switch Control Station: Wall Switch – Key operated three position wall switch.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands

indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade
  2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- F. Shadebands:
1. Shadeband Material: Light-blocking fabric
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
- G. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches
  2. Endcap Covers: To cover exposed endcaps.

## 2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
1. Manufacturer: Phifer Incorporated.
  2. Series: SheerWeave 7800
  3. Type: 48% Polyester /52% Acrylic Foamed Backing
  4. Weave: Basketweave.
  5. Thickness: .026 inches.
  6. Weight: 12.9 oz./sq. yd.
  7. Roll Width: 118 inches.
  8. Orientation on Shadeband: Up the roll, railroading is not recommended.
  9. Flame Spread Index Class A/Class I.
  10. Color: As selected by Architect from manufacturer's full range.

## 2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: As indicated on Drawings.

### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

### 3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 2413

## SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. Wood trim, 8 inches long.
3. One full-size solid surface material countertop, with front edge, 8 by 10 inches, of construction and in configuration specified.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

#### 1.4 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

#### 1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

## 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate windowsills and countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- A. Installer Qualifications: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.
- A. **Mockups:** Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
  - 1. Prior to final approval of Shop Drawings, erect 1 full size mock-up of each component at Project site demonstrating quality of materials and execution for Architect review.
  - 2. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from Project site.
  - 3. Approved mock-up will be used as standard for acceptance of subsequent work.
  - 4. Approved mock-ups may remain as part of finished work.

## 1.2 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.
- B. Storage and Handling Requirements:
  - 1. Store components indoors prior to installation.
  - 2. Handle materials to prevent damage to finished surfaces.

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of sills by field measurements after windows are installed, but before sill fabrication is complete.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's absolute limits.

## 1.8 WARRANTY

- A. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for a period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

## PART 2 - PRODUCTS

### 2.1 SOLID SURFACE COUNTERTOP MATERIALS (SSM-1)

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. **Basis of Design: Formica Corporation**
    - b. DuPont de Nemours, Inc.; Corian.
    - c. Wilsonart LLC.
    - d. Architect approved equal.
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
  - 3. Colors and Patterns: As selected by Architect from full range of manufacturer's collection specified.
- B. Particleboard: ANSI A208.1, Grade M-2.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- D. Marine Grade Plywood at all wet locations.

### 2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WT's "Architectural Woodwork Standards."
  - 1. Grade: Premium.
- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
- C. Configuration:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at top.
- D. Countertops: 1/2-inch-thick, solid surface material laminated to particleboard with exposed edges built up with 1/2-inch-thick, solid surface material.
- E. Backsplashes: 1/2-inch- thick, solid surface material.



- F. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.
  - 2. Install integral sink bowls in countertops in the shop.
- G. Joints: Fabricate countertops in sections for joining in field.
  - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
  - 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.
- H. Cutouts and Holes:
  - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
    - b. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch into fixture opening.
    - c. Provide 3/4-inch full bullnose edges projecting 3/8 inch into fixture opening.
  - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## 2.3 ACCESSORIES

- A. Wire-Management Grommets: Round Grommets with Brush, metal with matching caps and slot for wire passage.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide **Richelieu Metal Grommet #16602190**.
    - a. Outside Diameter: 2 3/8 inches.
    - b. Color: As selected by Architect.
    - c. Spacing: As indicated on Drawings.
    - d. Locations: Provide where indicated on drawings. Field verify final grommet locations in field with Owner/Architect.
- B. Surface- Mount Counter Support Brackets:
  - 1. Basis of Design Product: 1" Concealed Flat Bracket by A&M Hardware, Inc.
    - a. Provide Concealed Flat Bracket sized for 20-inch-deep counters and up.
    - b. Provide Concealed Flat Bracket sized for 10-inch-deep counters/shelving and up, with Inside Wall Brackets.

- c. Color: White
- d. Weight Capacity: 1100 lbs to 4900 lbs per pair.
- e. Spacing: 32 inches on center maximum.

C. Heavy Duty Folding Brackets:

- 1. Basis of Design Product: K-Fold Kolossus Heavy-Duty Folding Bracket by Richelieu
  - a. Provide Heavy Duty Folding Bracket sized for 24-inch deep counter.
  - b. Color: Gray
  - c. Weight Capacity: 1100lbs per pair.
  - d. Spacing: 16-24 inches on center standard.
  - e. Mounting: Mount on wall studs.

## 2.4 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive solid surface material and conditions under which will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of solid surface material.
- B. Do not begin installation until substrates have been properly prepared.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. If substrate preparation is the responsibility of another installer, notify Owner' representative of unsatisfactory preparation before proceeding.
- E. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### 1.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 1.3 FABRICATION

- A. Fabricate in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths using best method recommended by manufacturer.
  - 2. Fabricate to overhang front tops unless otherwise indicated.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts.
- B. Solid Surfacing: Fabricate up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

### 3.2 COUNTERTOP INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned, and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to

finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

### 3.3 CLEANING AND PROTECTION

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 123661.16

## SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Roll-up mats.
  - 2. Aluminum framing.

#### 1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

#### 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 floor mats and frames.
- B. Shop Drawings:
  - 1. Items penetrating floor mats and frames, including door control devices.
  - 2. Divisions between mat sections.
  - 3. Perimeter floor frames.
- C. Samples: For the following products, in manufacturer's standard sizes:
  - 1. Floor Mat: Section of floor mat.
  - 2. Frame Members: Sample of each type and color.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Structural Performance: Provide roll-up mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform floor load of 300 lbf/sq. ft..
  - 2. Wheel load of 350 lbs. per wheel.
- B. Accessibility Standard: Comply with applicable provisions in ICC A117.1.

### 2.2 ROLL-UP MATS (EF-1)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide; **Matter Surfaces, Style: Precision Inlay Super Nop 52 Logo** or comparable product by one of the following:
    - a. C/S Group
    - b. Architect Approved Equal.
  - 2. Mat Size: As indicated on Architectural Drawings.
  - 3. Overall Thickness: 1/2 inch.
  - 4. Pile Thickness: 7/16 inch.
  - 5. Overall Weight: 93 ounces/square yard
  - 6. Surface Flammability ASTM D2859: Passes.
  - 7. Pattern: Custom Precision Inlay digitally printed logo mat, graphic artwork file designed and provided by the Architect. Architect will provide a Vector file of the final graphic image for printing.
  - 8. Colors: As selected by Architect from manufacturer's full range.

### 2.3 FRAMES

- A. Recessed Frames: Subject to compliance with requirements, provide products by one of the following:
  - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide; **Matter Surfaces, Style: Aluminum Framing "L" Frame ALLFR**, or comparable product by one of the following:
    - a. C/S Group
    - b. Architect Approved Equal.
  - 2. Height: 7/16 inch.
  - 3. Length: 1 inch.
  - 4. Finish: As selected by Architect from manufacturer's full range.

## 2.4 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

## 2.5 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
  - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

## 2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
  - 1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.

2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
3. Delay setting mats until construction traffic has ended.

### 3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813



## **SECTION 21 0517 - SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

### **PART 2 - PRODUCTS**

#### **2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. 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.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.

5. Proco Products, Inc.

- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Stainless steel.
  3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "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-SEAL-FITTING INSTALLATION
- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
  - B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
  - C. Secure nailing flanges to concrete forms.
  - D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 21 0517

## **SECTION 21 0553 – IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- 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 and the proposed content for each label.
- D. Valve Schedules: Valve numbering scheme.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each piping system to include in maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
  - 2. Letter Color: Red.

3. Background Color: White.
  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-fourths the size of principal lettering.
  6. Fasteners: Stainless-steel rivets or self-tapping screws.
  7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- B. Letter Color: Red.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.
- D. Pipe-Label Colors:
  - 1. Background Color: Red.
  - 2. Letter Color: White.

## 2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
  - 1. Stencil Material: Fiberboard or metal.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032 inch thick, with predrilled holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain.
  - 3. Valve-Tag Color: Red.
  - 4. Letter Color: White.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 LABEL INSTALLATION

- 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 or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. 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. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

### 3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
  1. Valve-Tag Size and Shape:

- a. Wet-Pipe Sprinkler System: 1-1/2 inches square.

#### 3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 21 0553



## SECTION 21 1313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Pipes, fittings, and specialties.
2. Sprinklers.
3. Alarm devices.
4. Manual control stations.
5. Pressure gages.

#### 1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 250 psig maximum.

#### 1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 250-psig minimum working pressure.
  1. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
  2. Sprinkler Occupancy Hazard Classifications:
    - a. Building Service Areas: Ordinary hazard, Group 1.
    - b. Office, hotel and public: Light Hazard.
  3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler:

- a. Office Spaces: 225 sq. ft.
- b. Storage Areas: 130 sq. ft.
- c. Mechanical Equipment Rooms: 130 sq. ft.
- d. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

- C. Qualification Data: For qualified Installer.
- D. Delegated Design: Provide approved Sprinkler Piping Drawing, including: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable. Calculations and shop drawings shall be prepared by a NICET Level III or higher technician under the direction of a Registered Professional Engineer registered in New York State and shall be signed and sealed.
- E. Welding certificates.
- F. Fire-hydrant flow test report.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.
- I. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

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 ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."
  - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

## 1.8 COORDINATION

- A. Shop/Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at  $\frac{1}{4}" = 1'-0"$  scale, double lined. Drawings shall indicate pipe layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items and trades involved:
  - 1. Duct and piping installation in all spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct and piping layout.
  - 2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 3. Fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides.
  - 4. Detail location of anchors, alignment guides, and expansion joints and loops.
  - 5. Factory- and shop-fabricated ducts and fittings.
  - 6. Duct layout indicating sizes, configuration, liner material, static-pressure class, and service.
  - 7. Piping layout indicating sizes, configuration, and service.
  - 8. Elevation of top of ducts and pipes.
  - 9. Dimensions of main duct runs from building grid lines.
  - 10. Duct and pipe fittings.
  - 11. Reinforcement and spacing.
  - 12. Suspended ceiling components.
  - 13. Structural members to which duct and piping will be attached.
  - 14. Size and location of initial access modules for acoustical tile.
  - 15. Penetrations of smoke barriers and fire-rated construction.
  - 16. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling details and perimeter moldings.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. 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.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 250.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 250.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Shurjoint Piping Products.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
  - 2. Pressure Rating: 250 psig minimum.

3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

## 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.
  1. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
  1. Valves shall be UL listed or FM approved.
  2. Minimum Pressure Rating for High-Pressure Piping: 250 psig.
- B. Ball Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Victaulic Company.
  2. Standard: UL 1091 except with ball instead of disc.
  3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  5. Valves NPS 3: Ductile-iron body with grooved ends.
- C. Bronze Butterfly Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fivalco Inc.
    - b. Global Safety Products, Inc.
    - c. Milwaukee Valve Company.

2. Standard: UL 1091.
3. Pressure Rating: 250 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Standard: UL 312.
3. Pressure Rating: 250 psig.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

E. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Stockham Division.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
  - e. United Brass Works, Inc.
2. Standard: UL 262.
3. Pressure Rating: 250 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

F. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
  - b. American Valve, Inc.
  - c. Clow Valve Company; a division of McWane, Inc.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Kennedy Valve; a division of McWane, Inc.
  - f. Mueller Co.; Water Products Division.
  - g. NIBCO INC.
  - h. Tyco Fire & Building Products LP.
2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

## 2.5 TRIM AND DRAIN VALVES

### A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 250 psig minimum.

### B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.

### C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Affiliated Distributors.
  - b. Anvil International, Inc.
  - c. Conbraco Industries, Inc.; Apollo Valves.
  - d. Fire-End & Croker Corporation.
  - e. Fire Protection Products, Inc.
  - f. Kennedy Valve; a division of McWane, Inc.
  - g. Legend Valve.
  - h. Milwaukee Valve Company.
  - i. NIBCO INC.
  - j. Potter Roemer.
  - k. Red-White Valve Corporation.
  - l. Tyco Fire & Building Products LP.
  - m. Victaulic Company.
  - n. Watts Water Technologies, Inc.

### D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.

## 2.6 SPECIALTY VALVES

### A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

- a. High-Pressure Piping Specialty Valves: 250 psig minimum.
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.

B. Alarm Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AFAC Inc.
  - b. Globe Fire Sprinkler Corporation.
  - c. Reliable Automatic Sprinkler Co., Inc.
  - d. Tyco Fire & Building Products LP.
  - e. Venus Fire Protection Ltd.
  - f. Victaulic Company.
  - g. Viking Corporation.
- 2. Standard: UL 193.
- 3. Design: For horizontal or vertical installation.
- 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber and fill-line attachment with strainer.
- 5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
- 6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AFAC Inc.
  - b. Reliable Automatic Sprinkler Co., Inc.
  - c. Tyco Fire & Building Products LP.
- 2. Standard: UL 1726.
- 3. Pressure Rating: 250 psig minimum.
- 4. Type: Automatic draining, ball check.
- 5. Size: NPS 3/4.
- 6. End Connections: Threaded.

## 2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. National Fittings, Inc.
  - c. Tyco Fire & Building Products LP.



d. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Reliable Automatic Sprinkler Co., Inc.
  - b. Tyco Fire & Building Products LP.
  - c. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.
  - c. Potter Roemer.
2. Standard: UL 199.
3. Pressure Rating: 250 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AGF Manufacturing Inc.
  - b. Tyco Fire & Building Products LP.

- c. Victaulic Company.
  - d. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  3. Pressure Rating: 250 psig minimum.
  4. Body Material: Cast- or ductile-iron housing with sight glass.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.

## 2.8 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Globe Fire Sprinkler Corporation.
  2. Reliable Automatic Sprinkler Co., Inc.
  3. Tyco Fire & Building Products LP.
  4. Victaulic Company.
  5. Viking Corporation.
- B. General Requirements:
  1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating for Automatic Sprinklers: 250 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
  1. Early-Suppression, Fast-Response Applications: UL 176.
  2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
  1. Refer to Sprinkler Schedule.
- E. 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, plastic, white finish, one piece, flat.
  2. Sidewall Mounting: Chrome-plated steel, plastic, white finish, one piece, flat.

F. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements,] provide products by one of the following:
  - a. Reliable Automatic Sprinkler Co., Inc.
  - b. Tyco Fire & Building Products LP.
  - c. Victaulic Company.
  - d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMETEK; U.S. Gauge Division.
  2. Ashcroft, Inc.
  3. Brecco Corporation.
  4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gauge Range: 0 to 250 psig minimum.
- E. Water System Piping Gauge: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping at service entrance to building.
- B. Install backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping
- C. Install shutoff valve, check valve, pressure gage, 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, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain 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.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 21 0518 "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. 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.
- I. 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.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 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 Fire Department connection piping.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

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 26 0553 "Identification for Electrical Systems."

3.8 FIRE STOPPING INSTALLATION

- A. Fire-Barrier Penetrations: Maintain indicated fire rating of all walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Comply with requirements for fire stop materials and installations in Division 07 Section "Penetration Fire stopping."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  4. Energize circuits to electrical equipment and devices.
  5. 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.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

### 3.11 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
  - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  - 2. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:
  - 1. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
  - 2. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.12 SPRINKLER SCHEDULE

- A. Provide sprinkler types in subparagraphs below with finishes indicated.
  - 1. Concealed Sprinklers: Chrome plated, with factory-painted white cover plate.
  - 2. Upright Pendant and Sidewall Sprinklers: Chrome plated.
- B. Spare Sprinklers
  - 1. Provide a minimum of six (6) spare sprinklers for each type and temperature rating of sprinkler that is used on this project.
  - 2. Provide a spare sprinkler head box(s) and locate at a wall adjacent to the system riser.
  - 3. Provide spare sprinklers in spare sprinkler cabinet labeled "spare sprinklers". Mount on wall near sprinkler riser in accessible location.
  - 4. Provide appropriate sprinkler wrench for each type of sprinkler used on the project.

END OF SECTION 21 1313

**SECTION 220511**  
**MECHANICAL, ELECTRICAL AND PLUMBING COORDINATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 WORK INCLUDED**

- A. Work included in this section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
1. Motors.
  2. Factory-wired equipment (FEW).
  3. Factory-wired control panels (FWCP).
  4. Motor controllers where provided as part of mechanical equipment.
  5. Motor controllers where supplied under Division 23 – Mechanical Work.
  6. Disconnects and safety switches for mechanical equipment.
  7. Fuses for equipment provided, and starters and disconnect switches.

**1.3 REFERENCE STANDARDS**

- A. Published specification standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
1. ANSI – American National Standards Institute.
  2. NEMA – National Electrical Manufacturer’s Association.
  3. IEEE – Institute of Electrical and Electronic Engineers.

**1.4 CODE COMPLIANCE**

- A. All work shall be performed in compliance with the following:
1. New York State Education Department Planning Manual Standards.
  2. Building Code of New York State (2020).
  3. Mechanical Code of New York State (2020).
  4. Fuel Gas Code of New York State. (2020)
  5. Plumbing Code of New York State (2020).
  6. Fire Code of New York State (2020).
  7. Energy Conservation Construction Code of New York State (2020).
  8. National Electrical Code (NEC). Latest Edition
  9. Occupational Safety and Health Administration (OSHA). Latest Edition.
  10. Local Codes and Ordinances of the Town of Akron and Erie County.
  11. Life Safety Codes, NFPA 101.
  12. New York Board of Fire Underwriters.
  13. Combustion Toxicity Amendment to the New York State Uniform Fire Prevention and Building Code.
  14. Underwriters Laboratories.
  15. ASHRAE 15 Safety Code for Mechanical Refrigeration.

**1.5 QUALITY ASSURANCE**

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.04 of this Section and with all applicable National, State and local codes.



- D. All items of a given type shall be the products of the same manufacturer.

## **1.6 DIVISION OF WORK**

- A. This section delineates the work required to be performed by contractors under Divisions 23 and 26.

## **1.7 WORK REQUIRED UNDER DIVISION 22**

- A. Furnish motors, manual and combination starters, contactors, disconnect switches, and other electrical devices required for equipment furnished under Division 22. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 16. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers. Single phase starters shall be manual thermal switches with pilot lights and properly sized heaters. Thermostats, aquastats, controls and control wiring shall be included under Division 22 contractor.
- B. Install all items in piping and ductwork such as aquastats, etc.
- C. All external wiring of equipment, all control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 26. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 22 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Water Heater and Comminuter: The water heater and comminuter shall be provide by the Plumbing Contractor. Provision of the flue vents and accessories along with the control for the comminuter shall be by the Plumbing Contractor under Division 22.

## **1.8 WORK REQUIRED UNDER DIVISION 23**

- A. Furnish motors, manual and combination starters, contractors, and other electrical devices required for equipment furnished under Division 23. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 26. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers for control components. Include hand-off-auto switches with lights. Single phase starters shall be thermal switches with pilot light and properly sized heaters. All loose VFD's shall be furnished and installed by the Temperature Control Contractor
- B. Install all items in piping and ductwork such as aquastats, ductstats, etc.
- C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 23. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 23 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Furnish fuses for all equipment provided by the Mechanical Contractor.

## **1.9 WORK REQUIRED UNDER DIVISION 26**

- A. The Electrical Contractor, under Division 26, shall provide all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be responsible for proper direction of rotation for all three-phase equipment. The Electrical Contractor shall mount all starters, disconnects.
- B. The Electrical Contractor shall provide disconnect switches (sized as required) or thermal switches with pilot lights, on all mechanical equipment not furnished by Division 23 and as required by the National Electrical code, when equipment is not supplied with same.
- C. The Electrical Contractor shall provide single – or three-phase AC power, as required, to all mechanical equipment provided and installed by Division 23.
- D. All control devices (thermostats, etc.) required for mechanical equipment operation shall be provided, installed, and wired by the respective Mechanical Contractor.
- E. The Electrical Contractor shall disconnect all existing power connections to mechanical equipment prior to removal of equipment by others.
- F. The Electrical Contractor shall not purchase materials or initiate roughing work of electrical connections to equipment provided by other Contractors until receipt of reviewed submittals and coordination is completed.

#### **1.10 STORAGE**

- A. It shall be the contractor's responsibility to provide secure storage of new equipment and contractor's belongings at the construction site. Any equipment lost or damaged prior to acceptance by the owner shall be replaced with new equipment at no cost to the owner.

#### **1.11 RECORD DRAWINGS AND MAINTENANCE MANUALS**

- A. Refer to Division 01.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Motors:
  - 1. Baldor
  - 2. Siemens
  - 3. General Electric
  - 4. Reliance
- B. Motor Controllers and Disconnects:
  - 1. Square D
  - 2. Allen-Bradley
  - 3. Cutler-Hammer
  - 4. General Electric

#### **2.2 MOTORS**

- A. General: Motors shall conform to NEMA, IEEE, ANSI C50, and AIEE Standards.
- B. For motors less than 3/4 HP, furnish squirrel cage induction motors, capacitor-start or split-phase designed to operate on single phase, 60 hertz, 120-volt circuit (NEMA standard motor voltage 115V) with built-in overload protection.
- C. For motors 3/4HP and larger, furnish squirrel cage induction or wound rotor induction motors, designed to operate on 3-phase, 60-HZ, 208 or 460-volt circuit (NEMA Type "B": Insulation class, continuous duty standard motor voltage 460V), unless otherwise specified on drawings.

- D. Each motor shall not be overloaded by the apparatus it operates under any condition of operation. Where a minimum horsepower capacity is listed, furnish a motor larger than the minimum, if required in any particular case. Pay any additional cost due to necessary increase in feeder sizes, circuit breaker sizes, etc., provided under the Electric Contract.
- E. All 3-phase motors shall be built for continuous operation on stated voltage, plus or minus 10% volts.
- F. Belt-connected motors. Foundation slide base and shaft as required for aligning pulleys.
- G. Service Factor: The "Service Factor" is a multiplier, which applied to the normal horsepower rating indicates a permissible loading within the accepted safe limits of temperature rise for the insulation. Service factor for each motor shall conform to NEMA standards. Service factor for drip-proof enclosures is 1.15.
- H. Temperature and Insulation System Class: Conform to NEMA standards for Class B or better. Insulation system rated at 40°C maximum ambient temperature.
- I. Bearings: Equip motors 1/2 HP and larger with ball or roller bearings with pressure grease lubrication.
- J. Speed: As required and approved to meet the requirements of the service for which they are intended.
- K. Motor Housing: Conform to NEMA requirements for a drip-proof machine unless otherwise specified or indicated on the drawings.
- L. NEMA KVA locked rotor CODE LETTER: "G" or better.
- M. Efficiency:
  - 1. Per IEEE Standard 112, latest edition, Test Method B.
  - 2. Unless otherwise noted, all motors less than 1 HP shall be of standard efficiency.
  - 3. All motors 1 HP and larger shall comply with the following "High Efficiency" motor schedules as follows. Motors shall have guaranteed minimum efficiencies equivalent to or exceeding the following:

| HP    | Min. Eff. (%) | HP  | Min. Eff (%) |
|-------|---------------|-----|--------------|
| 1     | 85.5          | 30  | 93.0         |
| 1-1/2 | 86.5          | 40  | 93.6         |
| 2     | 86.5          | 50  | 94.0         |
| 3     | 89.0          | 60  | 94.5         |
| 5     | 89.5          | 75  | 95.0         |
| 7-1/2 | 91.0          | 100 | 95.0         |
| 10    | 91.7          | 125 | 95.0         |
| 15    | 92.0          |     |              |
| 20    | 92.4          |     |              |
| 25    | 93.0          |     |              |

### 2.3 SAFETY SWITCH

- A. Square D Co. Heavy Duty Series; Westinghouse Electric Corp. H-600, with the following:
  - 1. Fused or unfused as required.
  - 2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 16181 (U.L. Class RK-1, RK-5, L).

3. NEMA 1 enclosure unless otherwise indicated on drawing or required. 3R for devices installed outdoors.
  4. Switch rated 240V for 120V, 208V, 240V circuits; 600V for 277V, 480V circuits.
  5. Solid neutral bus when neutral or grounding conductor is included with circuit.
  6. Current rating and number of poles as indicated on drawings.
- B. Fused and non-fused disconnect switches shall be '2-pole' type with lug for ungrounded B phase' conductor and lug for the grounding conductor.

## **2.4 NAMEPLATES**

- A. Phenolic Type: Standard phenolic nameplates with 3/8" minimum size lettering engraved thereon to match existing. Adhesive backing.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Equipment shall be connected in a neat and skillful manner. Equipment deliver with terminal boxes that are inadequate shall be equipped with special boxes that suite the conditions by the Mechanical Contractor furnishing the equipment.
- B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18" long.
- C. All equipment shall be grounding with a green covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end. All electrical work required in the Mechanical Contracts shall conform to the applicable requirements of Division 26 of these Specifications.
- D. The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.
- E. Install heaters correlated with full load current of motors provided.
- F. Set overload devices to suit motors provided

### **3.2 INSTALLATION**

- A. Control Wiring:
1. Provide control wiring and connections.
  2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).
- B. Nameplates: Adhere the nameplate on the cover of NEMA 1 or 3R enclosures. Provide phenolic nameplates as follows:
1. On each remote control station, indicating motor controlled.
  2. On each disconnect switch, indicating purpose of switch.

### **3.3 DISCONNECTS**

- A. Motor Controllers: Provide safety switch for all motor controllers.
- B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.
- C. Provide safety switches for all factory packaged equipment.

- D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.
- E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc.

**END OF SECTION 220511**

**SECTION 220513**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
  2. Transition fittings.
  3. Dielectric fittings.
  4. Mechanical sleeve seals.
  5. Sleeves.
  6. Escutcheons.
  7. Grout.
  8. Plumbing demolition.
  9. Equipment installation requirements common to equipment sections.
  10. Painting and finishing.
  11. Supports and anchorages.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, and spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
1. CPVC: Chlorinated polyvinyl chloride plastic.
  2. PP: Polypropylene plastic.
- G. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

**1.4 SUBMITTALS**

- A. Product Data: For the following:
1. Transition fittings.
  2. Dielectric fittings.
  3. Mechanical sleeve seals.
  4. Escutcheons.

- B. Welding certificates.

## **1.5 QUALITY ASSURANCE**

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## **1.7 COORDINATION**

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

# **PART 2 - PRODUCTS**

## **2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## **2.2 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## **2.3 JOINING MATERIALS**

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM F 493.

## **2.4 TRANSITION FITTINGS**

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 40 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Eslon Thermoplastics.
    - b. Dresser Industries, Inc.; DMD Div.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Thompson Plastics, Inc.
    - b. Dresser Industries, Inc.; DMD Div.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  - 1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
    - c. Dresser Industries, Inc.; DMD Div.



- d. Ford.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

## **2.5 DIELECTRIC FITTINGS**

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Watts.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
  - a. Perfection Corp.
  - b. Precision Plumbing Products, Inc.
  - c. Sioux Chief Manufacturing Co., Inc.
  - d. Victaulic Co. of America.

## **2.6 MECHANICAL SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc. (Link Seal)
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  3. Pressure Plates: Stainless steel. Include two for each sealing element.
  4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## **2.7 SLEEVES**

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with set screws.

## **2.8 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Two-Piece, Cast-Brass Type: With set screw.
  1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  1. Finish: Polished chrome-plated and rough brass.
- E. Two-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. Two-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## **2.9 GROUT**

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 PLUMBING DEMOLITION**

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Provide piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Provide piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Provide piping to permit valve servicing.
- G. Provide piping at indicated slopes.
- H. Provide piping free of sags and bends.
- I. Provide fittings for changes in direction and branch connections.
- J. Provide piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Provide escutcheons for penetrations of walls, ceilings, and floors according to the following:
  1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.

- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
- l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- 2. Existing Piping: Use the following:
  - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
  - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
  - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
  - g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
  - h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
  - i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
  - j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
  - k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Provide sleeves for pipes passing through fire rated concrete and masonry walls and concrete floor and roof slabs.
- P. Provide sleeves for pipes passing through fire rated concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Provide sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Provide sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Sheet Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

- c. **Stack Sleeve Fittings:** For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
    - 1) Seal space outside of sleeve fittings with grout.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. **Underground, Exterior-Wall Pipe Penetrations:** Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. **Mechanical Sleeve Seal Installation:** Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. **Fire-Barrier Penetrations:** Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. **Soldered Joints:** Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. **Brazed Joints:** Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. **Threaded Joints:** Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. **Damaged Threads:** Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. **Welded Joints:** Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. **Flanged Joints:** Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. **PP 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.

### **3.4 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Provide unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Provide flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Provide equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Provide equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Provide plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Provide equipment to allow right of way for piping installed at required slope.

### **3.6 PAINTING**

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Paint all new and existing natural gas piping exposed to view at the gas meter set and in the boiler room with one (1) coat primer and two (2) coats finish metal alkyd enamel paint. (Yellow)

### **3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### **3.8 GROUTING**

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION 220513**

**SECTION 220517**  
**SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

**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.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

**2.3 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.



- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### **3.2 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: Cast-iron wall sleeves, Galvanized-steel wall sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves, Galvanized-steel wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall 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.
    - b. Piping NPS 6 and Larger: Cast-iron wall 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.

3. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
4. Interior Partitions:
  - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION 220517**

**SECTION 220518**  
**ESCUTCHEONS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

**2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange with holes for 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 type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

### **3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION 220518**

**SECTION 220523**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Bronze swing check valves.
  - 3. Iron gate valves.
- B. Related Sections:
  - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
  - 2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
  - 3. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

**1.3 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve indicated.
- B. O&M Data.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handlever: For quarter-turn valves.
- E. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.
  - 2. Threaded: With threads according to ASME B1.20.1.
- F. Valve Bypass and Drain Connections: MSS SP-45.

### **2.2 BRONZE BALL VALVES**

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. NIBCO INC.
    - c. Milwaukee Valve Company.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Stainless steel.
    - i. Ball: Stainless steel, vented.
    - j. Port: Full.

### **2.3 BRONZE SWING CHECK VALVES**

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Milwaukee Valve Company.
    - b. NIBCO INC.
    - c. Powell Valves.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.

### **2.4 IRON GATE VALVES**

- A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Milwaukee Valve Company.
  - b. NIBCO INC.
  - c. Powell Valves.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-70, Type I.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Disc: Solid wedge.
  - g. Packing and Gasket: Asbestos free.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### **3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Install valves in horizontal piping with stem at or above center of pipe.
- C. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.

### **3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  1. Shutoff Service: Ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  1. For Copper Tubing, NPS 2and Smaller: Threaded ends or solder-joint ends.

### **3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2and Smaller:
  1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.

3. Bronze Swing Check Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
1. Iron Gate Valves: Class 125 NRS.

**END OF SECTION 220523**



**SECTION 220529**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Metal pipe hangers and supports.
  2. Metal framing systems.
  3. Pipe positioning systems.
  4. Thermal-hanger shield inserts.

**1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

**2.2 METAL FRAMING SYSTEMS**

- A. Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
    - a. Anvil International; a subsidiary of Mueller Water Products Inc.
    - b. Cooper B-Line, Inc.
    - c. NIBCO INC.
    - d. Unistrut Corporation; Tyco International, Ltd.
  2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  3. Standard: MFMA-4.
  4. Channels: Continuous slotted steel channel with intumed lips.
  5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
  7. Metallic Coating: Electroplated zinc or Hot-dipped galvanized

**2.3 THERMAL-HANGER SHIELD INSERTS**

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

- B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## **2.4 PIPE POSITIONING SYSTEMS**

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

# **PART 3 - EXECUTION**

## **3.1 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- C. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- F. 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.
- G. 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.

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.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 4: 12 inches long and 0.048 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.2 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/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.

### **3.3 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.

### **3.4 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide 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 A 780.

### **3.5 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and metal framing systems and attachments for general service applications.
- F. Use thermal-hanger shield inserts for insulated piping and tubing.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  4. 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.
  5. 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.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

- K. 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.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- N. 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. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

**1.4 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets.

## **2.2 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Yellow.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## **2.3 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## **2.4 VALVE TAGS**

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## **2.5 WARNING TAGS**

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### **3.2 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.3 PIPE LABEL INSTALLATION**

- A. Piping Color-Coding: Painting of piping is specified in Section 09 9600 "High-Performance Coatings."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
  1. Identification Paint: Use for contrasting background.
  2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
  1. Domestic Water Piping:
    - a. Background Color: Blue
    - b. Letter Color: White.
  2. Pool Water Piping
    - a. Background Color: Blue
    - b. Letter Color: White.
  3. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

### **3.4 VALVE-TAG INSTALLATION**

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose



connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
  - a. Cold Water: 1-1/2 inches round.
  - b. Hot Water: 1-1/2 inches round.
2. Valve-Tag Color:
  - a. Cold Water: Natural.
  - b. Hot Water: Natural.
3. Letter Color:
  - a. Cold Water: Black.
  - b. Hot Water: Black.

**3.5 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION 220553**

**SECTION 220719**  
**PLUMBING PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Domestic chilled-water piping for drinking fountains.
  - 5. Sanitary waste piping exposed to freezing conditions.
  - 6. Storm-water piping exposed to freezing conditions.
  - 7. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Section 220716 "Plumbing Equipment Insulation."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory-and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## **1.8 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

# **PART 2 - PRODUCTS**

## **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- F. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## **2.2 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 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. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **2.3 SEALANTS**

### **A. Joint Sealants:**

1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

### **B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:**

1. Products: Subject to compliance with requirements, provide products by one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **2.4 FACTORY-APPLIED JACKETS**

- ### **A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:**
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

## **2.5 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. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.

- c. Proto Corporation; LoSmoke.
- d. Speedline Corporation; SmokeSafe.
- 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.

## 2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

## 2.7 SECUREMENTS

- A. Bands:
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with closed seal.
  - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, [1/2 inch] [3/4 inch] wide with [wing seal] [or] [closed seal].
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.

## **2.8 PROTECTIVE SHIELDING GUARDS**

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Engineered Brass Company.
    - b. Truebro; a brand of IPS Corporation.
    - c. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Truebro; a brand of IPS Corporation.
    - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Preparation: Clean and 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 apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.



### **3.4 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 07 8413 "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 07 8413 "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 MINERAL-FIBER INSULATION**

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
- D. 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.
- E. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.

### **3.7 FIELD-APPLIED JACKET INSTALLATION**

- A. 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.
- B. 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.

### **3.8 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 09 9123 "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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### **3.9 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### **3.10 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### **3.11 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: 1/2 inch thick.
  - 2. NPS 1 to 1-1/2: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation: 1 inch thick.
  - 3. NPS 1-1/2 and larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation: 1 inch thick.
- B. Domestic Hot and Recirculated Hot 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 to 1-1/2: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 3. NPS 1-1/2 and larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- C. Stormwater and Overflow:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. 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 inch thick.
- F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
- G. 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 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
  - 2. Encasement for piping.
- B. Related Requirements:
  - 1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

#### **1.3 SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.
- B. Coordination Drawings: Plans drawn at 1/4" = 1'-0" scale in AutoCAD format, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Duct and piping in all spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct and piping layout.
  - 2. Piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
  - 3. Elevation of top of ducts and piping.
  - 4. Suspended ceiling components.
  - 5. Structural members to which duct and piping will be attached.
  - 6. Size and location of access doors.
  - 7. Penetrations of smoke barriers and fire-rated construction.
- C. System purging and disinfecting activities report.
- D. Field quality-control reports.

### **PART 2 - PRODUCTS**

#### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

#### **2.2 COPPER TUBE AND FITTINGS**

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Industries.
    - b. Cambridge-Lee Industries.
    - c. Cerro Flow Products

- B. Soft Copper Tubing, Annealed Temper: ASTM B 88, Type K.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Industries.
    - b. Cambridge-Lee Industries.
    - c. Cerro Flow Products
- C. Wrought-Copper Fittings: ASME B16.22.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO.
    - b. Elkhart Products Corporation
    - c. Cello Products.
- D. Wrought-Copper Fittings: ASME B16.22.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO.
    - b. Elkhart Products Corporation
    - c. Cello Products.
  - 2. MSS SP-123.
  - 3. Cast-copper-alloy, hexagonal-stock body.
  - 4. Ball-and-socket, metal-to-metal seating surfaces.
  - 5. Solder-joint or threaded ends.
  - 6. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
  - 7. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 8. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

## **2.3 PIPING JOINING MATERIALS**

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.

## **2.4 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
    - a. Matco-Norca.
    - b. McDonald, A. Y. Mfg. Co.
    - c. Watts; a division of Watts Water Technologies, Inc.
    - d. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Nipples:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

- a. Elster Perfection Corporation.
- b. Grinnell Mechanical Products; Tyco Fire Products LP.
- c. Matco-Norca.
- d. Precision Plumbing Products, Inc.
- e. Victaulic Company.
- 2. Standard: IAPMO PS 66.
- 3. Electroplated steel nipple complying with ASTM F 1545.
- 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
- 5. End Connections: Male threaded or grooved.
- 6. Lining: Inert and noncorrosive, propylene.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. The indicated locations and arrangements of piping are schematic in intent with respect to floor plans, walls, ceilings, floor a decks, structure and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings. Minor deviations and offsets are permitted based on actual construction conditions encountered and as necessary in coordination with the work of other trades.
- B. Provide copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Provide full port ball shutoff valve, hose-end drain valve, strainer, pressure gauge and a test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- D. Provide a full port ball shutoff valve immediately upstream of each dielectric fitting.
- E. Provide domestic water piping level and plumb.
- F. Provide piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Provide and locate piping to permit valve servicing, removal and replacement.
- J. Provide 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.
- K. Provide piping with hanger spacing free of sags and bends.
- L. Provide fittings for changes in direction and branch connections.
- M. Provide unions in copper tubing at final connection to each piece of equipment, fixture and specialty.
- N. Provide thermometers on the inlet and outlet piping from each water heater and thermostatic mixing valves.



- O. Provide one-piece or two-piece escutcheons for piping penetrations of walls, and ceilings.
- P. Comply with the submitted manufacturer's written product data, including product technical bulletins, installation instructions and design drawings, including the following.
- Q. Piping Installation:
  - 1. Provide piping in compliance with manufacturer's Plumbing Installation Guide.

### **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. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.4 DIELECTRIC FITTING INSTALLATION**

- A. Provide dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Provide dielectric couplings, nipples, or unions.

### **3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
- B. Support vertical piping at the deck and midpoint between each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Provide hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

### **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. Provide transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with a full port ball shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide full port ball shutoff valve and a union for each connection.

### **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 FIELD QUALITY CONTROL**

- A. Provide for and perform the following tests and inspections:
  1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare written inspection reports and have them signed by authorities having jurisdiction and for the final O & M Manuals.
  2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
    - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
    - f. Provide for and prepare written reports for chlorination and pressure tests, for corrective action required and for the final O & M Manuals.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.

### **3.9 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. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.10 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. Provide for 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 chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Provide purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to NYSDOH approved laboratory and provide written test results to Architect/Engineer. Repeat procedures if biological examination shows contamination. Provide copies for the final O & M Manuals.
- C. Provide for prepare and submit written reports of purging and disinfecting activities for the final O & M Manuals. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.11 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, piping, NPS 3 and smaller, be the following:
  1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; joints.
- E. Aboveground domestic water piping, 3/4" and smaller, shall be the following:
  1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; joints.
- F. Aboveground domestic water piping, between 3" and 1", shall be the following:
  1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; joints

### **3.12 VALVE SCHEDULE**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Provide full port ball valves, lead free for piping NPS 2 inches and smaller. Provide full port ball or gate valves, lead free with flanged ends for piping NPS 2-1/2 inches and larger.
  - 2. Throttling Duty: Provide full port ball valves, lead free for piping NPS 2 inches and smaller. Provide full port ball or gate valves, lead free with flanged ends for piping NPS 2-1/2 inches and larger.
  - 3. Drain Duty: Full port threaded hose-end drain valves.
- B. Provide check valves to maintain correct direction of domestic water flow to and from equipment.

**END OF SECTION 221116**

**SECTION 221119**  
**DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Vacuum breakers.
  2. Balancing valves.
  3. Temperature-actuated, water mixing valves.
  4. Strainers.
  5. Trap-seal protection devices.
  6. Water hammer arrestors.
- B. Related Requirements:
1. Section 221116 "Domestic Water Piping".

**1.3 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
1. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

**2.3 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
  2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  3. Body: Bronze.
  4. Inlet and Outlet Connections: Threaded.
  5. Finish: Rough bronze or chrome plated.
  6. Basis of Design Manufacturer: Refer to equipment schedules for manufacturer, models, and sizes.

- B. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
  2. Body: Bronze, nonremovable, with manual drain.
  3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  4. Finish: Chrome or nickel plated.
  5. Basis of Design Manufacturer: Refer to equipment schedules for manufacturer, models, and sizes.

## **2.4 BALANCING VALVES**

- A. Memory-Stop Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    - d. ThermOmegaTech, Inc.
  2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  3. Pressure Rating: 400-psig minimum CWP.
  4. Size: NPS 2 or smaller.
  5. Body: Copper alloy.
  6. Port: Standard or full port.
  7. Ball: Chrome-plated brass.
  8. Seats and Seals: Replaceable.
  9. End Connections: Solder joint or threaded.
  10. Handle: Vinyl-covered steel with memory-setting device.
- B. Thermostatic Balancing Device
1. Provide a circuit solver type balancing device as indicated on the plans. Circuit solver shall be self-contained and fully automatic without additional piping or control mechanisms. Valve shall be a circuit solver as manufactured by Therm-Omega-Tech, Inc. or engineer approved equivalent.
    - a. Valve shall regulate the flow of recirculated domestic hot water based on water temperature entering the valve regardless of system operating pressure.
      - 1) Even when full closed the valve shall bypass a small amount hot water to maintain dynamic control of the recirculating loop.
      - 2) Valve shall be factor adjustable as required by project conditions.
      - 3) Valve shall be available in sizes ranging from ½ inch NPT to 2" NPT.
  2. Circuit Solver body and all internal components shall be constructed of stainless steel with major components constructed of type 303 stainless steel.
    - a. Valve sizes ½ inch through 2-inches shall be rated to 200 PSIG maximum working pressure.
      - 1) All valves shall be standard tapered female pipe, thread, NPT.
    - b. All valves shall be rated 300 degrees F. maximum working temperature.
    - c. All valves shall be NSF-61 certified for use in all domestic water systems.
    - d. Thermal actuator shall be spring loaded and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits.
  3. Installation of the valve shall be made by qualified tradesmen. Provide a valve in each domestic hot water return piping branch beyond last hot water device in that branch.
    - a. Provide suitable line size isolation valves, unions, and strainer as indicated in piping detail shown on the drawings.
    - b. Provide suitable access panel as required in non-accessible ceilings and walls.
  4. Basis of Design Manufacturer: ThermOmegaTech Model CS-A 3/4" or 1" – 120 Degree F.

## **2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

### **A. Primary, Thermostatic, Water Mixing Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Acorn Engineering Company.
  - c. Lawler Manufacturing Company, Inc.
  - d. Leonard Valve Company.
  - e. Powers, A Watts Brand.
  - f. Symmons Industries, Inc.
  - g. Zurn Industries, LLC.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounting on wall, adjustable, thermostatically controlled, water mixing valve. Includes internal wax operation mechanism, ASSE 1017 and CSA certified and can continuously maintain temperature at a flow rate as low as 0.5gpm.
5. Material: Bronze body, lead-free with corrosion-resistant interior components.
6. Connections: Threaded unions at inlets and outlet and full port ball valves.
7. Accessories: Manual temperature controls, integral check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: Field adjust to supply and not exceed 110 degrees F. at fixtures.
9. Tempered-Water Design Flow Rate: Refer to plans.
10. Pressure Drop at Design Flow Rate: Refer to plans.
11. Body and Valve Finishes: Rough bronze.
12. Supplied complete with temperature gauges at inlets and outlet.
13. Provide full port ball valves matching main sizes, pipe reducers and unions at inlets and outlet connections at final connection point to valve.
14. Basis of Design Manufacturer/Model: Refer to plans for equipment schedules for manufacturer, models, and sizes.

## **2.6 STRAINERS FOR DOMESTIC WATER PIPING**

### **A. Y-Pattern Strainers:**

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
6. Drain: Factory-installed, hose-end drain valve.

## **2.7 DRAIN VALVES**

### **A. Ball-Valve-Type, Hose-End Drain Valves:**

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## **2.8 WATER-HAMMER ARRESTERS**

### **A. Water-Hammer Arresters:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. Precision Plumbing Products, Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Watts Drainage Products.
  - e. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## **2.9 TRAP SEAL PROTECTION DEVICES**

### **A. Barrier Type Trap Seal Protection Devices:**

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. ProVent Plumbing Systems Inc.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Sure Seal Manufacturing
2. Standard: ASSE 1072-2007.
3. Body: ASB Plastic
4. Diaphragm & Sealing Gasket: Neoprene Rubber
5. Size: Based on floor drain size.
6. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Provide memory stop balancing valves in locations on piping where they can easily be adjusted. Provide for the adjustment for the total of all balance valves to equal the flow of the recirculation pump while flowing hot water at all fixtures. Provide a written description of the flow activity and set points for the balance valves and pump for the final O & M Manuals.
- B. Provide temperature-actuated, water mixing valves with thermometers, dielectric fittings or unions, check stops full port ball valves on inlets and outlet. Provide for the adjustment of flow and temperature settings of the mixing valve while flowing hot water at all hot supplied fixtures. The final mixed temperature set point of the valve shall permit a distribution temperature not to exceed 110 degrees F at any fixture. Provide a written test report for the final O & Manual to include the final set point temperatures.
- C. Provide Y-pattern strainers for water on the supply side of each pump and where shown on drawings.
- D. Provide water-hammer arresters in water piping on water closets, water piping feeding hand sprayer at three compartment sinks.
- E. Provide trap-seal protection devices in floor drains during trim out stage of project.

### **3.2 CONNECTIONS**

- A. Comply with requirements for ground equipment in Section 26 0526 "Grounding and Bonding for Electrical Systems."



### **3.3 FIELD QUALITY CONTROL**

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Provide written test and inspection reports for the Engineer and the final O & M Manuals.

### **3.4 ADJUSTING**

- A. Set field-adjustable flow set points of balancing valves.

**END OF SECTION 221119**

**SECTION 221316**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Pipe, tube, and fittings.
  2. Specialty pipe fittings.
  3. Encasement for underground metal piping.
- B. Related Sections:
1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.
  2. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water.

**1.4 SUBMITTALS**

1. Product Data: For each type of product indicated.

**1.5 PROJECT CONDITIONS**

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
  2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

**PART 2 - PRODUCTS**

**2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service class.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry.
    - b. AB&I Foundry.
    - c. Tyler Pipe.
  2. Gaskets: ASTM C 564, rubber.

## **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry.
    - b. AB&I Foundry.
    - c. Tyler Pipe.
- B. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
    - d. Tyler Pipe.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## **2.4 PVC PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

## **2.5 COPPER TUBE AND FITTINGS**

- A. DWV Copper Tubing:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Industries.
    - b. Cambridge-Lee Industries.
    - c. Cerro Flow Products
  - 2. Standards: ASTM B 306, Type DWV
  - 3. Description: Drainage tube, drawn temper.
- B. Copper Drainage Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Industries.
    - b. NIBCO.
    - c. Elkhart Products Corporation
    - d. Cello Products.
  - 2. Standards: ASME B16.23 or ASME B16.29.
  - 3. Description: Cast copper or wrought copper, solder-joint fittings.

- C. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## **2.6 SPECIALTY PIPE FITTINGS**

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Shielded Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cascade Waterworks Mfg. Co.
    - 2) Mission Rubber Company; a division of MCP Industries, Inc.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
4. Pressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cascade Waterworks Mfg. Co.
    - 2) Dresser, Inc.
    - 3) Smith-Blair, Inc.; a Sensus company.
    - 4) The Ford Meter Box Company, Inc.
    - 5) Viking Johnson.
  - b. Standard: AWWA C219.
  - c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
  - d. Center-Sleeve Material: Manufacturer's standard.
  - e. Gasket Material: Natural or synthetic rubber.
  - f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Capitol Manufacturing Company.
    - 2) Central Plastics Company.
    - 3) Hart Industries International, Inc.
    - 4) Jomar International Ltd.
    - 5) Matco-Norca, Inc.
    - 6) McDonald, A. Y. Mfg. Co.
    - 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - 8) Wilkins; a Zurn company.
  - b. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 125 psig minimum at 180 deg F End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Nipples:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Elster Perfection.
  - 2) Grinnell Mechanical Products.
  - 3) Matco-Norca, Inc.
  - 4) Precision Plumbing Products, Inc.
  - 5) Victaulic Company.
- b. Description:
  - 1) Standard: IAPMO PS 66
  - 2) Electroplated steel nipple.
  - 3) Pressure Rating: 300 psig at 225 deg F.
  - 4) End Connections: Male threaded or grooved.
  - 5) Lining: Inert and noncorrosive, propylene.

## **2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING**

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 2000 "Earth Moving."

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations are schematic in intent with regard to structure, routing, mechanical piping, electrical conduit locations and other design considerations. Provide piping as indicated unless deviations to layout are approved on coordination drawings. Minor deviations are permitted for coordination and to not delay the work schedule.
- B. Provide piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Provide piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Provide piping to permit valve servicing.
- F. Provide piping at indicated slopes.
- G. Provide piping free of sags and bends.
- H. Provide fittings for changes in direction and branch connections.
- I. Provide piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Provide long-turn, double Y-

branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Provide soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Provide cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Provide aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Provide engineered soil and waste drainage and vent piping systems as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- P. Plumbing Specialties:
  - 1. Provide cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 2. Provide drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Q. Do not enclose walls, ceilings, backfill, cover or place piping into operation until it is visually inspected and approved by authorities having jurisdiction.
- R. Provide sleeves for piping penetrations of walls, ceilings, and floors.
- S. Provide sleeve seals for piping penetrations of concrete walls and slabs.
- T. Provide escutcheons for piping penetrations of walls and ceilings.

### **3.3 JOINT CONSTRUCTION**

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. 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.
- E. Plastic, Non-Pressure-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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### **3.4 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  1. Provide transition couplings at joints of piping with small differences in OD's.
  2. In Drainage Piping: Shielded transition couplings.
- B. Dielectric Fittings:
  1. Provide dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  2. Dielectric Fittings for NPS 2 and Smaller: Provide dielectric nipples unions.
  3. Dielectric Fittings for NPS 2-1/2 to NPS 6: Provide dielectric flange kits or nipples.

### **3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Provide carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Provide carbon-steel pipe support clamps for vertical piping.
  3. Provide stainless-steel pipe support clamps for vertical piping in corrosive environments.
  4. Vertical Piping: MSS Type 8 or Type 42, clamps.
  5. Provide individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  7. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base, midpoint between decks and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Provide hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Provide supports for vertical cast-iron soil piping at each floor deck, mid-point of floors and every 15 feet.
- G. Provide hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
- H. Install supports for vertical copper tubing at each floor deck, midpoint of each floor and every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.6 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Provide test tees (wall cleanouts) in conductors above floor 18 to 24 inches and floor cleanouts with cover flush with floor.
  - 5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 6. Equipment: Connect drainage piping as indicated. Provide full port ball valve if indicated and union for each connection.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Provide unions in piping NPS 2 and smaller adjacent to each valve and at final connections to plumbing equipment.

### **3.7 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.8 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.



3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

### **3.9 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Provide plugs in ends of uncompleted sewer piping at end of each work day and when work stops.

### **3.10 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints. In plenum and open ceilings.
  2. Dissimilar Pipe-Material Couplings: Shielded transition couplings.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. In walls and non plenum ceilings.
- C. Aboveground, vent piping shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints. In plenum and open ceilings.
  2. Copper DWV tube, copper drainage fittings, and soldered joints. In plenum and open ceilings.
  3. Dissimilar Pipe-Material Couplings: Shielded transition couplings.
  4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. In walls and non plenum ceilings
- D. Underground, soil, waste, and vent piping shall be the following:
  1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  2. Dissimilar Pipe-Material Couplings: Shielded transition couplings.
  3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

**END OF SECTION 221316**

**SECTION 221319**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Roof flashing assemblies.
  - 4. Miscellaneous sanitary drainage piping specialties.

**1.3 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. PE: Polyethylene plastic.
- C. PP: Polypropylene plastic.
- D. PVC: Polyvinyl chloride plastic.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
  - 1. Grease interceptors.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

**1.6 COORDINATION**

- A. Coordinate size and location of roof penetrations.

**PART 2 - PRODUCTS**

**2.1 CLEANOUTS**

- A. Exposed Metal Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) MIFAB, Inc.
  - 2) Smith, Jay R. Mfg. Co.
  - 3) Watts Drainage Products.
  - 4) Zurn Plumbing Products Group.

## **2.2 FLOOR DRAINS**

### **A. Cast-Iron Floor Drains and Floor Sinks:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. Smith, Jay R. Mfg. Co.
  - c. Watts Drainage Products.
  - d. Zurn Plumbing Products Group;
- 2. Standard: ASME A112.6.3.
- 3. Pattern: Floor, sanitary drain for 3" or 4" pipe sizes.
- 4. Body Material: Acid resisting coated gray iron.
- 5. Seepage Flange: Required.
- 6. Anchor Flange: Required.
- 7. Clamping Device: Required.
- 8. Outlet: Bottom.
- 9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
- 10. Top or Strainer Material: Nickel bronze.
- 11. Top Shape: Square 6 x 6 inch.
- 12. Dimensions of Top or Strainer: 6-inch square nickel bronze with heavy duty grate and vandal proof.
- 13. Top Loading Classification: Medium Duty.
- 14. Barrier trap seal device for floor drain: Barrier trap seal device for use with floor drains to minimize trap seal evaporation. Product is comprised of an ABS rigid structure, silicone gasket, and seal for 2", 3" or 4" sizes. Device is engineered to comply with the performance requirements of ASSWE 1072 standard and is third party listed with IAPMO, ICC and ASSE. Zurn Industries Model Z1072 or Engineer approved equal.
- 15. Trap Material: Cast iron.
- 16. Trap Pattern: Deep-seal P-trap.
- 17. Refer to fixture schedule on drawings.

## **2.3 ROOF FLASHING ASSEMBLIES**

### **A. Roof Flashing Assemblies:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.
- 2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch thick, copper flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
  - a. Open-Top Vent Cap: Without cap.

## **2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES**

### **A. Floor-Drain, Trap-Seal Primer Fittings:**

- 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- B. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  2. Size: Same as connected stack vent or vent stack.

## **2.5 FLASHING MATERIALS**

- A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
1. General Applications: 12 oz./sq. ft.
  2. Vent Pipe Flashing: 8 oz./sq. ft.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Provide cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. Provide floor drains at low points of surface areas to be drained. Provide grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  3. Provide deep seal traps and trap guards for floor drains connected to sanitary building drain unless otherwise indicated.
- D. Provide roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- E. Provide copper flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- F. Provide air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- G. Provide traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 22 1316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

### **3.3 FLASHING INSTALLATION**

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
  - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counter-flashing or commercially made flashing fittings.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### **3.4 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.5 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION 221319**

**SECTION 224000  
PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following conventional plumbing fixtures and related components:
1. Faucets for lavatories, showers and sinks.
  2. Flushometers.
  3. Toilet seats.
  4. Protective shielding guards.
  5. Fixture supports.
  6. Water closets.
  7. Lavatories.
- B. Related Sections include the following:
1. Division 10 Section 102800 "Toilet, Bath, and Laundry Accessories."
  2. Division 22 Section 221119 "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
  3. Division 224700 Section "Drinking Fountains."

**1.3 DEFINITIONS**

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- D. PVC: Polyvinyl chloride plastic.
- E. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

**1.4 SUBMITTALS**

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  1. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  2. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
  3. Stainless-Steel Residential Sinks: ASME A112.19.3.
  4. Vitreous-China Fixtures: ASME A112.19.2M.
  5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  2. Faucets: ASME A112.18.1.
  3. Hose-Connection Vacuum Breakers: ASSE 1011.
  4. Hose-Coupling Threads: ASME B1.20.7.
  5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  6. NSF Potable-Water Materials: NSF 61.
  7. Pipe Threads: ASME B1.20.1.
  8. Supply Fittings: ASME A112.18.1.
  9. Brass Waste Fittings: ASME A112.18.2.
  10. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  11. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
  12. Hose-Coupling Threads: ASME B1.20.7.
  13. Manual-Control Antiscald Faucets: ASTM F 444.
  14. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
  15. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
  16. Atmospheric Vacuum Breakers: ASSE 1001.
  17. Brass and Copper Supplies: ASME A112.18.1.
  18. Dishwasher Air-Gap Fittings: ASSE 1021.
  19. Manual-Operation Flushometers: ASSE 1037.
  20. Flexible Water Connectors: ASME A112.18.6.
  21. Floor Drains: ASME A112.6.3.
  22. Off-Floor Fixture Supports: ASME A112.6.1M.
  23. Plastic Toilet Seats: ANSI Z124.5.
  24. Supply and Drain Protective Shielding Guards: ICC A117.1.



## **PART 2 - PRODUCTS**

### **2.1 LAVATORY FAUCETS**

- A. Lavatory Faucets:
  - 1. Provide the product indicated on Drawings.
  - 2. Description: Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    - a. See schedule on drawing.

### **2.2 SINK FAUCETS**

- A. Sink Faucets:
  - 1. Provide the product indicated on Drawings.
  - 2. Description: Kitchen faucet without spray. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    - a. See schedule on drawing.

### **2.3 FLUSHOMETERS**

- A. Flushometers:
  - 1. Provide the product indicated on Drawings
  - 2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
    - a. See schedule on drawing.

### **2.4 TOILET SEATS**

- A. Toilet Seats:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
    - a. Bemis Manufacturing Company.
    - b. Church Seats.
    - c. Olsonite Corp.
  - 2. Description: Heavy duty , commercial grade, toilet seat for water-closet-type fixture.
    - a. Material: Molded, solid plastic.
    - b. Configuration: Open front without cover.
    - c. Size: Elongated.
    - d. Hinge Type: CK, check.
    - e. Class: Standard commercial.
    - f. Color: White.

### **2.5 PROTECTIVE SHIELDING GUARDS**

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Plumberex Specialty Products Inc.
    - b. TCI Products.
    - c. TRUEBRO, Inc.
    - d. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## **2.6 FIXTURE SUPPORTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Company.
  - 2. MIFAB Manufacturing Inc.
  - 3. Smith, Jay R. Mfg. Co.
  - 4. Tyler Pipe; Wade Div.
  - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
  - 1. Description: Combination carrier designed for accessible and/or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Lavatory Supports:
  - 1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
  - 2. Accessible-Fixture Support: Include rectangular steel uprights.
- D. Sink Supports:
  - 1. Description: Sink carrier with concealed in wall with arms and tie rods. Include steel uprights with feet.

## **2.7 WATER CLOSETS**

- A. Water Closets:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. American Standard Companies, Inc.
    - b. Eljer.
    - c. Kohler Co.
    - d. Sloan Valve Company.
  - 2. See schedule on drawing.

## **2.8 LAVATORIES**

- A. Lavatories:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. American Standard Companies, Inc.
    - b. Crane Co.
    - c. Kohler Co.
    - d. Mansfield.
    - e. Toto.
    - f. Acorn
  - 2. See schedule on drawing.

## **2.9 KITCHENETTE SINKS**

- A. Kitchen Sinks:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Elkay Mfg. Co.
    - b. Just Mfg. Co.

- c. Moen, Div. of Stanadyne.
- 2. See schedule on drawing.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Provide off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  - 1. Provide carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Provide carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Provide chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Provide floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Provide wall-mounting fixtures with tubular waste piping attached to supports.
- E. Provide counter-mounting fixtures in and attached to casework.
- F. Provide fixtures level and plumb according to roughing-in drawings.
- G. Provide water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Provide full port ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- H. Provide traps, trap offsets and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Provide tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Provide flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Provide toilet seats on water closets, secure and flushed and aligned with bowl.
- L. Provide traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- M. Provide chrome plated escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Provide deep-pattern escutcheons if required to conceal protruding fittings.
- N. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

- O. Seal all joints between fixture edges and walls, floors and countertops using sanitary-type, one-part mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

### **3.4 FIELD QUALITY CONTROL**

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### **3.5 ADJUSTING**

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.

### **3.6 CLEANING**

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### **3.7 PROTECTION**

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION 224000**

## SECTION 230500 - COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. HVAC demolition.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Concrete bases.
  - 11. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Watts Industries, Inc.; Water Products Div.
    - f. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F (7 deg C).
  - 1. Available Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.



2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  1. Underdeck Clamp: Clamping ring with set screws.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000-psi, 28-day compressive strength.
  3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated on drawings to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.

- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
  - 2. Existing Piping: Use the following:
    - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - d. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
    - e. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
    - f. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.4 PIPING CONNECTIONS

- A. 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. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.6 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 4500-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Sections.

### 3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.10 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 230500

## SECTION 230510 - BASIC MECHANICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Mechanical sleeve seals.
  - 3. Sleeves.
  - 4. Escutcheons.
  - 5. Grout.
  - 6. Mechanical demolition.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Concrete bases.
  - 9. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.4 SUBMITTALS

- A. Welding certificates.
- B. All mechanical equipment and systems.



## 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## PART 2 - PRODUCTS

### 2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.

### 2.3 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

### 2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

### 2.6 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 MECHANICAL DEMOLITION

- A. Refer to Section "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. All cutting and patching associated with the Mechanical work shall be the responsibility of the Mechanical Contractor. Walls, floors, ceilings and roofing shall be returned to the original condition. Flashing of all roof penetrations for equipment in the mechanical contract shall be included in the mechanical contract. Ceiling removal, storage and reinstallation shall be included in the mechanical contract. All surfaces and equipment shall be returned to their original condition.
- E. Temperature Contractors shall be responsible for his own cutting, patching, demolition and removals. Wiring shall be checked if being reused. All abandoned wiring and conduits shall be removed back to the source.

### 3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. All lubrication shall be performed per the manufacturers printed instructions prior to start-up.

### 3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment. The mechanical contractor shall be responsible to furnish and install all miscellaneous steel (not shown on the structural drawings), and equipment for the support of equipment furnished under their contract. All welding shall be performed by certified welders.
- C. All lintels required for the mechanical work shall be furnished and installed by the mechanical contractor.
- D. Field Welding: Comply with AWS D1.1.

### 3.4 FIRE-STOPPING

- A. Contractor shall be responsible for fire-stopping of all openings around mechanical systems at fire and smoke rated wall and floor assemblies.
- B. Provide materials and products listed by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems." The system shall meet the requirements of "Fire Tests of Through-Penetrations Fire-Stops" designated ASTM E814.
- C. Provide rated, fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires and ductwork pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
- D. Fire Stopping Systems
  - 1. Safing Insulation
    - a. Unfaced, semi-rigid batt insulation, produced by combining semi-refractory mineral fibers from slag with thermosetting resin binders, to comply with ASTM C 612 for the Class indicated; passing ASTM E136 for combustion characteristics; and as follows:
      - 1) Medium Density Semi-Rigid Board: Class 3, nominal density of 6 lbs. per cu. ft., R-value of 4.16 at 75 degrees F.; United States Gypsum "Thermafiber Fire Safing Insulation"; Manville Engineered Systems Group "Pyro-Fiber".
    - b. Fire Stopping Sealants
      - 1) At all large penetrations through fire-rated walls and floors, such as multiple conduits or pipes routed through a single opening; single component, pourable, trowel finished, water based endothermic fire protection sealant; 3M "FireDam 150 Caulk".
      - 2) At all cracks, slots, small holes through fire-rated walls & floors: gun-grade sealant; 3M "FireBarrier Caulk", CP "25 N/S No-Sag", and CP "25 S/L Self-Leveling".
      - 3) Acceptable Equivalent: USG Interiors "Thermafiber Smoke-Seal Compound".

E. Installation of Firestopping Systems

1. Safing insulation and firestopping sealant system: (Similar to UL System No. HW-S-0001 for 1 & 2 hour rated partitions)
  - a. Seal all gaps at perimeter of floor slabs; all openings between floors; all penetrations through fire separate zones; as required to maintain the fire rating of wall assemblies and floor/ceiling assemblies; and as indicated on the drawings.
  - b. Install firestopping safing insulation in strict accordance with manufacturer's printed instructions. Pack each void space completely full with safing insulation. Do not use thermal or acoustical insulation for this purpose. Leave one half inch recess for firestopping sealant.
  - c. Apply fire stopping sealant to furnish the closure, using a standard caulking gun, trowel, or other acceptable method, in accordance with the manufacturer's printed instructions.
  - d. Do not install safing insulation, fireproofing, or firestopping sealants until the construction has progressed to the point that they will not be wet or damaged by inclement weather.

3.5 TRAINING

- A. Prior to acceptance of all systems and equipment, the contractor, along with his subcontractors and vendors, shall instruct and train the owner's representatives on the operation and maintenance of all aspects of the new systems. Owner shall be given ample time to schedule training dates and personnel. Training sessions shall be given at intervals of 4 hours long. Training literature for startup procedures and maintenance shall be included in the O&M Manuals. All training sessions shall be video taped by the contractor and turned over to the Owner in a DVD format.

3.6 SYSTEM COMMISSIONING AND TESTING

- A. All new heating and ventilating systems and equipment shall be started up and operated at normal operating temperatures for a period of 24 hours (minimum) to "bake-off" the equipment. The associated ventilation systems shall run on 100% outside air during this procedure for an additional eight hours to purge the building. This work shall be completed prior to school occupancy, or if the work is not completed in time for summer "bake-off", on a Saturday with the Contractor responsible for being on the site during the entire purge and bake-off operation.
- B. Prior to commencement of work, the Contractor effecting such system shall survey all building electrical systems and components, including fire alarm, security, communications, clock and computer; make written notice to the Owner regarding existing damages, missing items and incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the owner's representatives that all building system has been returned to their original conditions.
- C. Commissioning and testing of HVAC systems shall occur while the school is not occupied by students, and only after notice to the Owners Representative is made at least 24 hours in advance. The Mechanical Contractor shall be responsible for providing filter media over all supply air registers and diffusers during the HVAC system start-up procedure. The Mechanical Contractor shall provide airtight plastic covers over all supply and return openings prior to the start of construction by any contractor. The plastic shall be maintained airtight throughout the project construction and removed only with the approval of the owner's representative.

### 3.7 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as art of the General Construction work on the architectural drawings. Refer to “General Conditions of the Contract for Construction,” for additional requirements. Cut and drill from both sides of wall and/or floors. Patch abandoned holes left by removal of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation.

### 3.8 PAINTING

- A. Include painting for patch work with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats. Refer to General Construction Specifications for additional information.
- B. All Mechanical, Electrical, Plumbing and Fire Protection components shall be painted by the Division installing the work.
- C. All painting shall consist of one (1) prime coat and two (2) finish coats on non-lead oil base paint, of color as selected unless otherwise indicated herein. Color-coding of all piping shall be done. Paint shall be comparable to Baltimore Paint Company. Provide heat resistant paint where temperatures are over 400°F. Provide Pittsburgh galvanized iron primer for all galvanized surfaces. All surfaces shall be thoroughly cleaned prior to painting. All rust, scales, dirt, oil, grease, protective film, labels, etc., shall be removed and all corrosion shall be wire brushed to pipe surface.
- D. Paint all hangers, supports, brackets, bare iron piping and any other bare iron work including tanks, supports, legs, etc., in all exposed, finished and concealed areas. Copper tubing in exposed areas shall be cleaned and painted chrome plated silver or unless otherwise specified. Cast iron piping in exposed areas shall be cleaned of all mud, rust, scale, debris, etc., and painted. The entire perimeter of all piping shall be painted. Paint all piping if installed in finished rooms.
- E. Paint all exterior metal or iron including all piping, stacks, exhaust pipes, supporting metals hardware, etc. This shall include galvanized steel. Paint with galvanized primer and finish with epoxy of color selected. Exterior metal painting shall include all exposed piping, fittings, valves, conduits, boxes, all gas piping on roofs and walls, all hardware, manhole and catch basin covers, water and gas valve box covers, sewer cleanouts, etc.
- F. All exposed piping installed on the face of exterior walls shall be painted to match the wall color unless otherwise specified or directed by the Owner.
- G. Unless otherwise specified, paint all piping and insulation exposed in Pool Filter Rooms, Boiler Rooms, Mechanical Equipment Rooms, Storage Rooms, Basements, Classrooms rooms without ceilings , and any other exposed to view piping or insulation, including insulation jacket with two (2) coats of oil base paint of color as selected. Piping shall be color coded painted corresponding to labeling.
- H. Color coding piping and equipment shall be according to OSHA approved standards. Submit color charts.
- I. Paint all uninsulated water pump casings and piping connections to ensure corrosion protection.

### 3.9 CONCEALMENT

- A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install on after Owner's Representative review and comments on arrangement and appearance.

### 3.10 ACCESS PANELS

- A. Access panels shall be furnished by the Mechanical and Electrical Trades and install by General Contractor. Location and size shall be the responsibility of each trade. Access panels over 324 square inches shall have two cam locks. Contractor shall provide proper frame and door type for various wall or ceiling finishes. Access panels shall provide proper frame and door type for various all or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by inland Steel Products Co., Milwaukee, Wisconsin.

### 3.11 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4" high (unless otherwise indicated); shape and size to accommodate equipment. Set anchor bolts in sleeves before pouring and after anchoring and leveling, fill equipment bases with grout.

### 3.12 FINAL PIPING CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents.
- B. Provide final steam, condensate, hot water, glycol, chilled and condenser water, drain, vent, oil line and gas connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow, and rail connections extended to floor drains.
- C. Provide for Owner Furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers as required.

END OF SECTION 230510

## SECTION 230511 – MECHANICAL, ELECTRICAL AND PLUMBING COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 WORK INCLUDED

- A. Work included in this section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
  - 1. Motors.
  - 2. Factory-wired equipment (FEW).
  - 3. Factory-wired control panels (FWCP).
  - 4. Motor controllers where provided as part of mechanical equipment.
  - 5. Motor controllers where supplied under Division 23 – Mechanical Work.
  - 6. Disconnects and safety switches for mechanical equipment.
  - 7. Fuses for equipment provided, and starters and disconnect switches.

#### 1.3 REFERENCE STANDARDS

- A. Published specification standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
  - 1. ANSI – American National Standards Institute.
  - 2. NEMA – National Electrical Manufacturer’s Association.
  - 3. IEEE – Institute of Electrical and Electronic Engineers.

#### 1.4 CODE COMPLIANCE

- A. All work shall be performed in compliance with the following:
  - 1. New York State Education Department Planning Manual Standards.
  - 2. Building Code of New York State (2020).
  - 3. Mechanical Code of New York State (2020).
  - 4. Fuel Gas Code of New York State. (2020)
  - 5. Plumbing Code of New York State (2020).
  - 6. Fire Code of New York State (2020).
  - 7. Energy Conservation Construction Code of New York State (2020).
  - 8. National Electrical Code (NEC). Latest Edition
  - 9. Occupational Safety and Health Administration (OSHA). Latest Edition.
  - 10. Local Codes and Ordinances of the Town of Silver Creek and Chautauqua County.
  - 11. Life Safety Codes, NFPA 101.
  - 12. New York Board of Fire Underwriters.
  - 13. Combustion Toxicity Amendment to the New York State Uniform Fire Prevention and Building Code.
  - 14. Underwriters Laboratories.
  - 15. ASHRAE 15 Safety Code for Mechanical Refrigeration.



## 1.5 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.04 of this Section and with all applicable National, State and local codes.
- D. All items of a given type shall be the products of the same manufacturer.

## 1.6 DIVISION OF WORK

- A. This section delineates the work required to be performed by contractors under Divisions 23 and 26.

## 1.7 WORK REQUIRED UNDER DIVISION 22

- A. Furnish motors, manual and combination starters, contactors, disconnect switches, and other electrical devices required for equipment furnished under Division 22. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 16. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers. Single phase starters shall be manual thermal switches with pilot lights and properly sized heaters. Thermostats, aquastats, controls and control wiring shall be included under Division 22 contractor.
- B. Install all items in piping and ductwork such as aquastats, etc.
- C. All external wiring of equipment, all control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 26. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 22 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Water Heater and Comminuter: The water heater and comminuter shall be provide by the Plumbing Contractor. Provision of the flue vents and accessories along with the control for the comminuter shall be by the Plumbing Contractor under Division 22.

## 1.8 WORK REQUIRED UNDER DIVISION 23

- A. Furnish motors, manual and combination starters, contractors, and other electrical devices required for equipment furnished under Division 23. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 26. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers for control components. Include hand-off-auto switches with lights. Single phase starters shall be thermal switches with pilot light and properly sized heaters. All loose VFD's shall be furnished and installed by the Temperature Control Contractor.
- B. Install all items in piping and ductwork such as aquastats, ductstats, etc.

- C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 23. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 23 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Furnish fuses for all equipment provided by the Mechanical Contractor.

#### 1.9 WORK REQUIRED UNDER DIVISION 26

- A. The Electrical Contractor, under Division 26, shall provide all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be responsible for proper direction of rotation for all three-phase equipment. The Electrical Contractor shall mount all starters, disconnects.
- B. The Electrical Contractor shall provide disconnect switches (sized as required) or thermal switches with pilot lights, on all mechanical equipment not furnished by Division 23 and as required by the National Electrical code, when equipment is not supplied with same.
- C. The Electrical Contractor shall provide single – or three-phase AC power, as required, to all mechanical equipment provided and installed by Division 23.
- D. All control devices (thermostats, etc.) required for mechanical equipment operation shall be provided, installed, and wired by the respective Mechanical Contractor.
- E. The Electrical Contractor shall disconnect all existing power connections to mechanical equipment prior to removal of equipment by others.
- F. The Electrical Contractor shall not purchase materials or initiate roughing work of electrical connections to equipment provided by other Contractors until receipt of reviewed submittals and coordination is completed.

#### 1.10 STORAGE

- A. It shall be the contractor's responsibility to provide secure storage of new equipment and contractor's belongings at the construction site. Any equipment lost or damaged prior to acceptance by the owner shall be replaced with new equipment at no cost to the owner.

#### 1.11 RECORD DRAWINGS AND MAINTENANCE MANUALS

- A. Refer to Division 01.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Motors:
  - 1. Baldor
  - 2. Siemens
  - 3. General Electric
  - 4. Reliance

- B. Motor Controllers and Disconnects:
  - 1. Square D
  - 2. Allen-Bradley
  - 3. Cutler-Hammer
  - 4. General Electric

## 2.2 MOTORS

- A. General: Motors shall conform to NEMA, IEEE, ANSI C50, and AIEE Standards.
- B. For motors less than 3/4 HP, furnish squirrel cage induction motors, capacitor-start of split-phase designed to operate on single phase, 60 hertz, 120-volt circuit (NEMA standard motor voltage 115V) with built-in overload protection.
- C. For motors 3/4HP and larger, furnish squirrel cage induction or wound rotor induction motors, designed to operate on 3-phase, 60-HZ, 208 or 460-volt circuit (NEMA Type “B”: Insulation class, continuous duty standard motor voltage 460V), unless otherwise specified on drawings.
- D. Each motor shall not be overloaded by the apparatus it operates under any condition of operation. Where a minimum horsepower capacity is listed, furnish a motor larger than the minimum, if required in any particular case. Pay any additional cost due to necessary increase in feeder sizes, circuit breaker sizes, etc., provided under the Electric Contract.
- E. All 3-phase motors shall be built for continuous operation on stated voltage, plus or minus 10% volts.
- F. Belt-connected motors. Foundation slide base and shaft as required for aligning pulleys.
- G. Service Factor: The “Service Factor” is a multiplier, which applied to the normal horsepower rating indicates a permissible loading within the accepted safe limits of temperature rise for the insulation. Service factor for each motor shall conform to NEMA standards. Service factor for drip-proof enclosures is 1.15.
- H. Temperature and Insulation System Class: Conform to NEMA standards for Class B or better. Insulation system rated at 40°C maximum ambient temperature.
- I. Bearings: Equip motors 1/2 HP and larger with ball or roller bearings with pressure grease lubrication.
- J. Speed: As required and approved to meet the requirements of the service for which they are intended.
- K. Motor Housing: Conform to NEMA requirements for a drip-proof machine unless otherwise specified or indicated on the drawings.
- L. NEMA KVA locked rotor CODE LETTER: “G” or better.
- M. Efficiency:
  - 1. Per IEEE Standard 112, latest edition, Test Method B.
  - 2. Unless otherwise noted, all motors less than 1 HP shall be of standard efficiency.

3. All motors 1 HP and larger shall comply with the following “High Efficiency” motor schedules as follows. Motors shall have guaranteed minimum efficiencies equivalent to or exceeding the following:

| HP    | Min. Eff. (%) | HP  | Min. Eff (%) |
|-------|---------------|-----|--------------|
| 1     | 85.5          | 30  | 93.0         |
| 1-1/2 | 86.5          | 40  | 93.6         |
| 2     | 86.5          | 50  | 94.0         |
| 3     | 89.0          | 60  | 94.5         |
| 5     | 89.5          | 75  | 95.0         |
| 7-1/2 | 91.0          | 100 | 95.0         |
| 10    | 91.7          | 125 | 95.0         |
| 15    | 92.0          |     |              |
| 20    | 92.4          |     |              |
| 25    | 93.0          |     |              |

## 2.3 SAFETY SWITCH

- A. Square D Co. Heavy Duty Series; Westinghouse Electric Corp. H-600, with the following:
  1. Fused or unfused as required.
  2. Fused switches equipped with fuseholders to accept only the fuses specified in Section 16181 (U.L. Class RK-1, RK-5, L).
  3. NEMA 1 enclosure unless otherwise indicated on drawing or required. 3R for devices installed outdoors.
  4. Switch rated 240V for 120V, 208V, 240V circuits; 600V for 277V, 480V circuits.
  5. Solid neutral bus when neutral or grounding conductor is included with circuit.
  6. Current rating and number of poles as indicated on drawings.
- B. Fused and non-fused disconnect switches shall be ‘2-pole’ type with lug for ungrounded B phase’ conductor and lug for the grounding conductor.

## 2.4 NAMEPLATES

- A. Phenolic Type: Standard phenolic nameplates with 3/8” minimum size lettering engraved thereon to match existing. Adhesive backing.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Equipment shall be connected in a neat and skillful manner. Equipment deliver with terminal boxes that are inadequate shall be equipped with special boxes that suite the conditions by the Mechanical Contractor furnishing the equipment.
- B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18” long.

- C. All equipment shall be grounding with a green covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end. All electrical work required in the Mechanical Contracts shall conform to the applicable requirements of Division 26 of these Specifications.
- D. The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.
- E. Install heaters correlated with full load current of motors provided.
- F. Set overload devices to suit motors provided

### 3.2 INSTALLATION

- A. Control Wiring:
  - 1. Provide control wiring and connections.
  - 2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).
- B. Nameplates: Adhere the nameplate on the cover of NEMA 1 or 3R enclosures. Provide phenolic nameplates as follows:
  - 1. On each remote control station, indicating motor controlled.
  - 2. On each disconnect switch, indicating purpose of switch.

### 3.3 DISCONNECTS

- A. Motor Controllers: Provide safety switch for all motor controllers.
- B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.
- C. Provide safety switches for all factory packaged equipment.
- D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.
- E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc.

END OF SECTION 230511

## SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

| FULL-LOAD EFFICIENCIES FOR 60 HZ NEMA PREMIUM EFFICIENCY ELECTRIC MOTORS RATED 600 VOLTS OR LESS (RANDOM WOUND) |                    |                    |                    |                    |                    |                    |
|-----------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                                                                                                 | OPEN MOTORS        |                    |                    |                    |                    |                    |
|                                                                                                                 | 2 POLE             |                    | 4 POLE             |                    | 6 POLE             |                    |
| HP                                                                                                              | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY |
| 1                                                                                                               | 77.0               | 74.0               | 85.5               | 82.5               | 82.5               | 80.0               |
| 1.5                                                                                                             | 84.0               | 81.5               | 86.5               | 84.0               | 86.5               | 84.0               |
| 2                                                                                                               | 85.5               | 82.5               | 86.5               | 84.0               | 87.5               | 85.5               |
| 3                                                                                                               | 85.5               | 82.5               | 89.5               | 87.5               | 88.5               | 86.5               |
| 5                                                                                                               | 86.5               | 84.0               | 89.5               | 87.5               | 89.5               | 87.5               |
| 7.5                                                                                                             | 88.5               | 86.5               | 91.0               | 89.5               | 90.2               | 88.5               |
| 10                                                                                                              | 89.5               | 87.5               | 91.7               | 90.2               | 91.7               | 90.2               |
| 15                                                                                                              | 90.2               | 88.5               | 93.0               | 91.7               | 91.7               | 90.2               |
| 20                                                                                                              | 91.0               | 89.5               | 93.0               | 91.7               | 92.4               | 91.0               |
| 25                                                                                                              | 91.7               | 90.2               | 93.6               | 92.4               | 93.0               | 91.7               |
| 30                                                                                                              | 91.7               | 90.2               | 94.1               | 93.0               | 93.6               | 92.4               |
| 40                                                                                                              | 92.4               | 91.0               | 94.1               | 93.0               | 94.1               | 93.0               |
| 50                                                                                                              | 93.0               | 91.7               | 94.5               | 93.6               | 94.1               | 93.0               |
| 60                                                                                                              | 93.6               | 92.4               | 95                 | 94.1               | 94.5               | 93.6               |
| 75                                                                                                              | 93.6               | 92.4               | 95                 | 94.1               | 94.5               | 93.6               |
| 100                                                                                                             | 93.6               | 92.4               | 95.4               | 94.5               | 95.0               | 94.1               |

| FULL-LOAD EFFICIENCIES FOR 60 HZ NEMA PREMIUM EFFICIENCY ELECTRIC MOTORS RATED 600 VOLTS OR LESS (RANDOM WOUND) |                    |                    |                    |                    |                    |                    |
|-----------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                                                                                                 | ENCLOSED MOTORS    |                    |                    |                    |                    |                    |
|                                                                                                                 | 2 POLE             |                    | 4 POLE             |                    | 6 POLE             |                    |
| HP                                                                                                              | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY | NOMINAL EFFICIENCY | MINIMUM EFFICIENCY |
| 1                                                                                                               | 77.0               | 74.0               | 85.5               | 82.5               | 82.5               | 80.0               |
| 1.5                                                                                                             | 84.0               | 81.5               | 86.5               | 84.0               | 87.5               | 85.5               |
| 2                                                                                                               | 85.5               | 82.5               | 86.5               | 84.0               | 88.5               | 86.5               |
| 3                                                                                                               | 86.5               | 84.0               | 89.5               | 87.5               | 89.5               | 87.5               |
| 5                                                                                                               | 88.5               | 86.5               | 89.5               | 87.5               | 89.5               | 87.5               |
| 7.5                                                                                                             | 89.5               | 87.5               | 91.7               | 90.2               | 91.0               | 89.5               |
| 10                                                                                                              | 90.2               | 88.5               | 91.7               | 90.2               | 91.0               | 89.5               |
| 15                                                                                                              | 91.0               | 89.5               | 92.4               | 91.0               | 91.7               | 90.2               |
| 20                                                                                                              | 91.0               | 89.5               | 93.0               | 91.7               | 91.7               | 90.0               |
| 25                                                                                                              | 91.7               | 90.2               | 93.6               | 92.4               | 93.0               | 91.7               |
| 30                                                                                                              | 91.7               | 90.2               | 93.6               | 92.4               | 93.0               | 91.7               |
| 40                                                                                                              | 92.4               | 91.0               | 94.1               | 93.0               | 94.1               | 93.0               |
| 50                                                                                                              | 93.0               | 91.7               | 94.5               | 93.6               | 94.1               | 93.0               |
| 60                                                                                                              | 93.6               | 92.4               | 95.0               | 94.1               | 94.5               | 93.6               |
| 75                                                                                                              | 93.6               | 92.4               | 95.4               | 94.5               | 94.5               | 93.6               |
| 100                                                                                                             | 94.1               | 93.0               | 95.4               | 94.5               | 95.0               | 94.1               |

## 2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.



## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

## SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

## 2.2 STACK-SLEEVE FITTINGS

- 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:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Smith, Jay R. Mfg. Co.
  - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
- C. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
- C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## 2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Presealed Systems.
- C. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

## 2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
  - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
  - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall 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.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall 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.
  - 4. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - 5. Interior Partitions:
    - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.

END OF SECTION 230517

## SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

#### 2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Insulated Piping: One-piece, stamped-steel type.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
  - 2. Escutcheons for Existing Piping:
    - a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
    - e. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.
  - 2. Existing Piping: Split-casting, floor-plate type.

### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

## SECTION 230519 - METERS AND GAUGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gauges.
  - 4. Gauge attachments.
  - 5. Test plugs.
  - 6. Sight flow indicators.
  - 7. Pitot-tube flowmeters.
  - 8. Venturi flowmeters.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Product Certificates: For each type of meter and gauge, from manufacturer.
- D. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue organic liquid.
  - 6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
  - 7. Window: Glass.
  - 8. Stem: Aluminum and of length to suit installation.
    - a. Design for Air-Duct Installation: With ventilated shroud.
    - b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.2 DUCT-THERMOMETER MOUNTING BRACKETS

- A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

## 2.3 THERMOWELLS

- A. Thermowells:
  1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  3. Material for Use with Copper Tubing: CNR or CUNI.
  4. Material for Use with Steel Piping: CRES or CSA
  5. Type: Stepped shank unless straight or tapered shank is indicated.
  6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
  7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
  8. Bore: Diameter required to match thermometer bulb or stem.
  9. Insertion Length: Length required to match thermometer bulb or stem.
  10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAUGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gauges:
  1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Standard: ASME B40.100.
  3. Case: Sealed type; cast aluminum; 6-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.
  7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
  8. Pointer: Dark-colored metal.
  9. Window: Glass.
  10. Ring: Brass.
  11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.5 GAUGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## 2.6 TEST PLUGS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F
- F. Core Inserts: EPDM self-sealing rubber.

## 2.7 SIGHT FLOW INDICATORS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Description: Piping inline-installation device for visual verification of flow.
- C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- D. Minimum Pressure Rating: 150 psig.
- E. Minimum Temperature Rating: 200 deg F.
- F. End Connections for NPS 2 and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 and Larger: Flanged.

## 2.8 FLOWMETERS

- A. Pitot-Tube Flowmeters:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Description: Flowmeter with sensor and indicator.
  - 3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
  - 4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.
    - a. Design: Differential-pressure-type measurement for water.
    - b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
    - c. Minimum Pressure Rating: 150 psig.
    - d. Minimum Temperature Rating: 250 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Integral Transformer: For low-voltage power connection.
7. Accuracy: Plus or minus 3 percent.
8. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

B. Venturi Flowmeters:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.
  - a. Design: Differential-pressure-type measurement for water.
  - b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
  - c. Minimum Pressure Rating: 250 psig.
  - d. Minimum Temperature Rating: 250 deg F.
  - e. End Connections for NPS 2 and Smaller: Threaded.
  - f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
  - g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.
5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch-diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.
  - a. Scale: Gallons per minute.
  - b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range
6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.
  - a. Scale: Gallons per minute.
  - b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Conversion Chart: Flow rate data compatible with sensor.
9. Operating Instructions: Include complete instructions with each flowmeter.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

- F. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- G. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at the most readable position.
- H. Install valve and snubber in piping for each pressure gauge for fluids.
- I. Install test plugs in piping tees.
- J. Install flow indicators in piping systems in accessible positions for easy viewing.
- K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- L. Install flowmeter elements in accessible positions in piping systems.
- M. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- N. Install permanent indicators on walls or brackets in accessible and readable positions.
- O. Install connection fittings in accessible locations for attachment to portable indicators.
- P. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic zone.
  - 2. Inlet and outlet of each hydronic boiler.
  - 3. Two inlets and two outlets of each chiller.
  - 4. Inlet and outlet of each hydronic coil in air-handling units.
  - 5. Outside-, return-, supply-, and mixed-air ducts.
- Q. Install pressure gauges in the following locations:
  - 1. Discharge of each pressure-reducing valve.
  - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
  - 3. Suction and discharge of each pump.

### 3.2 CONNECTIONS

- A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Connect flowmeter transmitters to meters.

### 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gauges to proper angle for best visibility.

### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- C. Thermometers at inlets and outlets of each chiller shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- E. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
- F. Thermometer stems shall be of length to match thermowell insertion length.

### 3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 100 deg
- B. Scale Range for Condenser-Water Piping: 0 to 100 deg F.
- C. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.
- D. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

### 3.6 PRESSURE-GAUGE SCHEDULE

- A. Pressure gauges at discharge of each pressure-reducing valve shall be the following:
  - 1. Sealed, direct-mounted, metal case.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- B. Pressure gauges at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:
  - 1. Sealed, direct-mounted, metal case.
  - 2. Test plug with EPDM self-sealing rubber inserts.
- C. Pressure gauges at suction and discharge of each pump shall be the following:
  - 1. Sealed, direct-mounted, metal case.
  - 2. Test plug with EPDM self-sealing rubber inserts.

### 3.7 PRESSURE-GAUGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 100 psi.
- B. Scale Range for Condenser-Water Piping: 0 to 100 psi
- C. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi

### 3.8 FLOWMETER SCHEDULE

- A. Flowmeters for Chilled-Water Piping: Pitot-tube or Venturi type.
- B. Flowmeters for Condenser-Water Piping: Pitot-tube or Venturi type.
- C. Flowmeters for Heating, Hot-Water Piping: Pitot-tube or Venturi type.

END OF SECTION 230519



## SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Bronze gate valves.
  - 3. Iron gate valves.
  - 4. Iron swing check valves
  - 5. Iron, grooved-end swing-check valves.
  - 6. Chainwheels
- B. Related Sections:
  - 1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set gate valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller.
  - 3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.

## 2.2 BRONZE BALL VALVES

### A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

## 2.3 IRON SWING CHECK VALVES

### A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Milwaukee Valve Company.
  - b. NIBCO INC.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
  - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
  - d. Body Design: Clear or full waterway.
  - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - f. Ends: Flanged.
  - g. Trim: Bronze.
  - h. Gasket: Asbestos free.

## 2.4 IRON GLOBE VALVES

### A. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.
  - b. Hammond Valve.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.

2. Description:
  - a. Standard: MSS SP-85, Type I.
  - b. CWP Rating: 500 psig.
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Packing and Gasket: Asbestos free.

## 2.5 IRON GATE VALVES

### A. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-70, Type I.
  - b. NPS 2-1/2 to NPS 12,
  - c. SWP Rating: 200 psig.
  - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - e. Ends: Flanged.
  - f. Trim: Bronze.
  - g. Disc: Solid wedge.
  - h. Packing and Gasket: Asbestos free.

## 2.6 IRON SWING CHECK VALVES

### A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Milwaukee Valve Company.
  - b. NIBCO INC.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
  - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
  - d. Body Design: Clear or full waterway.
  - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - f. Ends: Flanged.
  - g. Trim: Bronze.
  - h. Gasket: Asbestos free.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball and gate valves and more than 96 inches above floor. Extend chains to 60 inches above finished floor

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or gate valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

### 3.5 HOT WATER AND GLYCOL VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

1. Bronze Ball Valves: Solder-joint, Two piece, full port, bronze with bronze trim.
2. DZR Brass Ball Valves: Plain ends, Two piece, full port with chrome-plated brass trim.

#### B. Pipe NPS 2-1/2 and Larger:

1. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Single-flange, 150-psig CWP rating, ferrous alloy, with EPDM liner.
3. Iron Butterfly Valves: Grooved ends, 300-psig CWP.

#### C. Pipe NPS 2-1/2 and Larger:

1. Iron Gate Valves: Flanged pipe fitting installation, Class 125 NRS.
2. Iron swing check valves: Flanged or grooved fitting installation.

### 3.6 LOW-PRESSURE STEAM VALVE SCHEDULE (15 PSIG OR LESS)

#### A. Pipe NPS 2 and Smaller:

1. Bronze Swing Check Valves: Class 150, bronze disc.
2. Bronze Globe Valve: Class 150, bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Swing Check Valves: Class 250, metal seats.
2. Iron Globe Valves: Class 250, regular glad, flanged.

### 3.7 STEAM-CONDENSATE VALVE SCHEDULE

#### A. Pipe NPS 2 and Smaller:

1. Bronze Swing Check Valves: Class 150, bronze disc.
2. Bronze Globe Valves: Class 150, bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Swing Check Valves: Class 250, metal seats.
2. Iron Globe Valves: Class 250, regular glad, flanged.

END OF SECTION 230523

## SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.
- B. Related Sections:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
  - 3. Division 23 Section "Metal Ducts" for duct hangers and supports.

#### 1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Pipe stands.
  - 4. Equipment supports.

- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- B. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel
- C. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.



## 2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  - 3. Standard: MFMA-4.
  - 4. Channels: Continuous slotted steel channel with inturred lips.
  - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
  - 7. Metallic Coating: Hot-dipped galvanized.
  - 8. Paint Coating: Vinyl, Epoxy or Alkyd
  - 9. Plastic Coating: Polyurethane or Epoxy

## 2.4 THERMAL-HANGER SHIELD INSERTS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: Plastic.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
  - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 2. Bases: One or more; plastic.
  - 3. Vertical Members: Two or more protective-coated-steel channels.
  - 4. Horizontal Member: Protective-coated-steel channel.
  - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install 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.
  - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports or metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 8, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 8 if little or no insulation is required.
  - 4. 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.
  - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
  - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 7. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
  - 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
  - 11. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 8.
  - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 13. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 8, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 8, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 15. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 8 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  - 16. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 8, from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 8, from single rod if horizontal movement caused by expansion and contraction might occur.
  - 18. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 8 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  - 19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 8 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  - 20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 8 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 8.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 8 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. 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 Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529



## SECTION 230548 – WIND AND/OR SEISMIC LOAD RATED ROOF CURBS AND RESTRAINT BRACKETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Furnish roof curbs, wind load and/or seismic restraint brackets and related items as required to support rooftop-mounted HVAC units and to restrain against wind-induced and/or seismic motion
- B. All curb mounted rooftop HVAC units shall be connected to roof curbs with wind load and/or seismic restraint brackets of size, type and quantity as determined by restraint bracket manufacturer. Restraint brackets shall restrain against forces generated by wind and/or seismic from any direction as required by latest versions of the International Building Code, California Building Code, Florida Building Code, American Society of Civil Engineers Standard 7, or other applicable codes.
- C. Wind load and/or seismic rated curbs are to be designed and constructed to resist the effects of site-specific maximum considered earthquake ground motion according to the requirements of the International Building Code and the American Society of Civil Engineers. Curb walls are to be of heavy gage galvanized steel side construction, and minimum wall thickness is determined by analyzing the stresses generated when the wind load and/or seismic design force acts on the rooftop unit.
- D. The roof curb shall be attached to the building structure at the curb base flanges. Base flange attachment options include anchor bolts, welded connections and mechanical fasteners. Flange connection minimum quantity is to be determined by analyzing the stresses generated by the wind load and/or seismic design forces acting on the rooftop unit and the roof curb.
- E. This specification is to be a minimum requirement for wind load and/or seismic design consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements.

#### 1.3 SUBMITTALS

- A. Submittals shall demonstrate that the specific wind load and/or seismic restraint brackets utilized are in compliance with the specifications. Submittals shall include type of connection hardware required.
- B. Drawings shall showing wind restraint and/or seismic bracket dimensions, make and model of compatible rooftop unit.
- C. A manufacturer's statement showing that the wind load and/or seismic restraint brackets will meet the applicable code requirements. Statement is to include wind restraint and/or seismic calculations signed and sealed by a professional engineer (PE) registered in the state where the project is located.

- D. The magnitude of the wind-induced force and/or seismic load is to be determined by governing code requirements. The wind-generated and/or seismic force is to be reduced into an equivalent statically applied force. The statically applied force is to act in horizontal and vertical directions at the center of gravity of the rooftop mounted equipment, resulting in torsion, flexure, tension and shear forces that the restraint brackets must be shown to be able to resist.

#### 1.4 QUALITY ASSURANCE

- A. Wind restraint and/or seismic brackets shall meet governing building code standards, as demonstrated by comprehensive analysis that the load resisting capabilities meet or exceed all applicable requirements. All such systems must be installed in strict accordance with applicable codes and manufacturers' standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.
- B. Wind restraint and/or seismic calculations shall be provided for all connections of rooftop-mounted equipment to the roof curb and the roof curb to the structure. Calculations are to be signed and sealed by a professional engineer (PE) registered in the state where the project is located.
- C. All restraint materials shall be provided by the same manufacturer and shall be certified by the manufacturer. Wind load and/or seismic restraint brackets shall be made of a material that is compatible with the roof curb and the rooftop unit baserail material.
- D. Dissimilar metals are not to be used.
- E. All wind load and/or seismic restraint brackets shall be of galvanized steel or galvalume construction.

### PART 2 - PRODUCTS

#### 2.1 CONSTRUCTION

- A. Roof curbs shall be constructed:
  - 1. By Thybar Corporation, model VibroCurb III spring isolation with 2" deflection or equivalent equal. Include spring isolation on all curbs.
  - 2. Prime G-90 galvanized steel, with a wall thickness as determined by a
  - 3. 26" minimum height, and tall enough that rooftop unit base is a minimum of 14" above finished roof.
  - 4. Fully welded mitered corners for wind load and/or seismic load.
  - 5. Base flange attachments for securing curb to building structure.
  - 6. Factory installed 2" x 4" wood nailer for attachment of roofing material.
  - 7. Curbs shall be insulated at the factory or field insulated by the Mechanical Contractor.
- B. Restraint brackets are to be provided by the curb manufacturer for connecting rooftop unit to curb.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's written instructions. Wind load and/or seismic restraint brackets must not be installed in a manner that will result in rooftop unit baserail damage or roof curb reduced weight carrying capacity.
- B. The roof curb shall be placed prior to the installation of the wind load and/or seismic restraint brackets. Brackets shall be installed prior to installation of rooftop unit.
- C. Prior to performing installation of restraint brackets, Contractor is to notify project designer of any conflicts with other trades or equipment that may result in undesirable contact due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- D. Contractor is to notify project designer of any discrepancies between the specifications and field conditions or changes required due to specific equipment selection prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.

### 3.2 INSPECTION

- A. On completion of installation of all wind load and/or seismic restraint brackets herein specified, the Contractor shall inspect the completed system and report in writing any installation error or other faults in the system that could affect the wind load and/or seismic resistant capabilities of the roof top assembly. The Contractor shall submit a report to the project designer, including the above report with consequent steps taken to properly complete the wind load restraint installation.

END OF SECTION 230548

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.
  - 5. Valve tags.
  - 6. Warning tags.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

#### 1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  4. Fasteners: Stainless-steel rivets or self-tapping screws.
  5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus 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), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

## 2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum
  - 2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting".
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  1. Heating Water Piping:
    - a. Background Color: Red.
    - b. Letter Color: Black.

### 3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  1. Supply Ducts:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.
  2. Return Ducts:
    - a. Background Color: Red.
    - b. Letter Color: White.

3. Outside-Air Ducts:
    - a. Background Color: Blue.
    - b. Letter Color: White.
  4. Exhaust Ducts:
    - a. Background Color: Green.
    - b. Letter Color: White.
  5. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

### 3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
    - a. Hot Water: 1-1/2 inches, round.
  2. Valve-Tag Color:
    - a. Hot Water: Natural Brass.
  3. Letter Color:
    - a. Hot Water: Black.

### 3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553



## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
    - b. Variable-air-volume systems.
  - 2. Balancing Hydronic Piping Systems:
    - a. Constant-flow hydronic systems.
    - b. Variable-flow hydronic systems.
    - c. Primary-secondary hydronic systems.

#### 1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

#### 1.4 SUBMITTALS

- A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.

- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity currently certified by NEBB. Entity shall maintain certification through project completion.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB as a TAB technician.
- B. TAB Conference: Meet with Architect on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide 2-weeks advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## 1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine 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.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine automatic balancing valves. Remove balancing valve cartridge and flush clean prior to system balance and verification.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" in this Section.
  - 1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer. Provide sheaves and belts as required to achieve indicated airflows.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts. Provide sheaves and belts as required to achieve indicated airflows.

### 3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
  - 1. Balance variable-air-volume systems the same as described for constant-volume air systems.
  - 2. Set terminal units and supply fan at full-airflow condition.
  - 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  - 4. Readjust fan airflow for final maximum readings.
  - 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
  - 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
  - 7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
  - 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
    - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

### 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check liquid level in expansion tank.
  - 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
  - 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
  - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 6. Set system controls so automatic valves are wide open to heat exchangers.
  - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect and comply with requirements in Division 23 Section "Hydronic Pumps."
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
    - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.

- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.
  - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

### 3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

### 3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

### 3.11 FOR HEAT EXCHANGERS

- A. Measure water flow through all circuits.
- B. Adjust water flow to within specified tolerances.
- C. Measure inlet and outlet water temperatures.
- D. Check settings and operation of safety and relief valves. Record settings.

### 3.12 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.



### 3.13 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
  - 1. Entering- and leaving-water temperature.
  - 2. Water flow rate.
  - 3. Water pressure drop.
  - 4. Dry-bulb temperature of entering and leaving air.
  - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
  - 6. Airflow.
  - 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each refrigerant coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Wet-bulb temperature of entering and leaving air.
  - 3. Airflow.
  - 4. Air pressure drop.
  - 5. Refrigerant suction pressure and temperature.

### 3.14 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer's name, model number, and serial number.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.15 PROCEDURES FOR CHILLERS

- A. Balance water flow through the chiller to within specified tolerances of indicated flow with all pumps operating. Measure and record the following data with chiller operating at design conditions:
  - 1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
  - 2. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
  - 3. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
  - 4. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
  - 5. Capacity: Calculate in tons of cooling.

### 3.16 PROCEDURES FOR COOLING TOWERS

- A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:
  - 1. Measure condenser-water flow to each cell of the cooling tower.
  - 2. Measure entering- and leaving-water temperatures.
  - 3. Measure wet- and dry-bulb temperatures of entering air.
  - 4. Measure wet- and dry-bulb temperatures of leaving air.
  - 5. Measure condenser-water flow rate recirculating through the cooling tower.
  - 6. Measure cooling-tower spray pump discharge pressure.
  - 7. Adjust water level and feed rate of makeup water system.
  - 8. Measure flow through bypass.

### 3.17 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### 3.18 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  - 2. Air Outlets and Inlets: Plus or minus 10 percent.
  - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
  - 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

### 3.19 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly 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.

### 3.20 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB contractor.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.

- D. System Diagrams: Include schematic layouts of air 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 with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches (mm), and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches (mm), and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
  3. Test Data (Indicated and Actual Values):
    - a. Total air flow rate in cfm (L/s).
    - b. Total system static pressure in inches wg (Pa).
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg (Pa).
    - e. Filter static-pressure differential in inches wg (Pa).
    - f. Preheat-coil static-pressure differential in inches wg (Pa).
    - g. Cooling-coil static-pressure differential in inches wg (Pa).
    - h. Heating-coil static-pressure differential in inches wg (Pa).
    - i. Outdoor airflow in cfm (L/s).
    - j. Return airflow in cfm (L/s).
    - k. Outdoor-air damper position.
    - l. Return-air damper position.
    - m. 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 (mm) o.c.
- f. Make and model number.
- g. Face area in sq. ft. (sq. m).
- h. Tube size in NPS (DN).
- i. Tube and fin materials.
- j. Circuiting arrangement.
- 2. Test Data (Indicated and Actual Values):
  - a. Air flow rate in cfm (L/s).
  - b. Average face velocity in fpm (m/s).
  - c. Air pressure drop in inches wg (Pa).
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
  - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
  - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
  - h. Water flow rate in gpm (L/s).
  - i. Water pressure differential in feet of head or psig (kPa).
  - j. Entering-water temperature in deg F (deg C).
  - k. Leaving-water temperature in deg F (deg C).
  - l. Refrigerant expansion valve and refrigerant types.
  - m. Refrigerant suction pressure in psig (kPa).
  - n. Refrigerant suction temperature in deg F (deg C).
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  - 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches (mm), and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches (mm), and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    - g. Number, make, and size of belts.
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm (L/s).
    - b. Total system static pressure in inches wg (Pa).
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg (Pa).
    - e. Suction static pressure in inches wg (Pa).

- H. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F (deg C).
    - d. Duct static pressure in inches wg (Pa).
    - e. Duct size in inches (mm).
    - f. Duct area in sq. ft. (sq. m).
    - g. Indicated air flow rate in cfm (L/s).
    - h. Indicated velocity in fpm (m/s).
    - i. Actual air flow rate in cfm (L/s).
    - j. Actual average velocity in fpm (m/s).
    - k. Barometric pressure in psig (Pa).
- I. 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. (sq. m).
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm (L/s).
    - b. Air velocity in fpm (m/s).
    - c. Preliminary air flow rate as needed in cfm (L/s).
    - d. Preliminary velocity as needed in fpm (m/s).
    - e. Final air flow rate in cfm (L/s).
    - f. Final velocity in fpm (m/s).
    - g. Space temperature in deg F (deg C).
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm (L/s).
    - b. Entering-water temperature in deg F (deg C).
    - c. Leaving-water temperature in deg F (deg C).
    - d. Water pressure drop in feet of head or psig (kPa).
    - e. Entering-air temperature in deg F (deg C).
    - f. Leaving-air temperature in deg F (deg C).

- K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in gpm (L/s).
    - g. Water pressure differential in feet of head or psig (kPa).
    - h. Required net positive suction head in feet of head or psig (kPa).
    - i. Pump rpm.
    - j. Impeller diameter in inches (mm).
    - k. Motor make and frame size.
    - 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 (kPa).
    - b. Pump shutoff pressure in feet of head or psig (kPa).
    - c. Actual impeller size in inches (mm).
    - d. Full-open flow rate in gpm (L/s).
    - e. Full-open pressure in feet of head or psig (kPa).
    - f. Final discharge pressure in feet of head or psig (kPa).
    - g. Final suction pressure in feet of head or psig (kPa).
    - h. Final total pressure in feet of head or psig (kPa).
    - i. Final water flow rate in gpm (L/s).
    - j. Voltage at each connection.
    - k. Amperage for each phase.
- L. Instrument Calibration Reports:
1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.21 INSPECTIONS

#### A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 5 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Verify that balancing devices are marked with final balance position.
  - e. Note deviations from the Contract Documents in the final report.

#### B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. 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."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

#### C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

#### D. Prepare test and inspection reports.

### 3.22 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593



## SECTION 230713 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "HVAC Piping Insulation."
  - 3. Division 23 Section "Metal Ducts" for duct liners.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.
- C. Coordination Drawings: Refer to Section 013100 "Project Management and Coordination".
- D. Qualification Data: For qualified Installer.
- E. 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.
- F. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 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 "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. 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.
- H. Mineral-Fiber Board Insulation:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. 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 FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; FlameChek.
    - b. Johns Manville; Firetemp Wrap.
    - c. Thermal Ceramics; FireMaster Duct Wrap.
    - d. 3M; Fire Barrier Wrap Products.
    - e. Unifrax Corporation; FyreWrap.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. PVC Jacket Flashing Sealants:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.
  - 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

## 2.6 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Width: 2 inches
  - 3. Thickness: 6 mils
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

## 2.7 SECUREMENTS

- A. Bands:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
  - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
- B. Insulation Pins and Hangers:
  - 1. Capacitor-Discharge-Weld Pins:
    - a. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
    - b. Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - 2. Cupped-Head, Capacitor-Discharge-Weld Pins:
    - a. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
    - b. Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - 3. Insulation-Retaining Washers:
    - a. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
    - b. Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
    - c. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

- C. Staples:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. 0.080-inch nickel-copper alloy.

## 2.8 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Floor Penetrations:
  - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 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.
- B. Prior to installation, thoroughly clean ductwork to remove oil, grease, and debris. Lay out all insulation materials in a clean area. Coat ductwork to be insulated with manufacturers recommended adhesive.
  - 1. Utilizing stiff bristled brush or short pile fabric roller, brush adhesive or roll adhesive. Apply adhesive in a thin, uniform layer to both insulation surface and mating jacket surface. All overlapping joints shall be fully covered with adhesive on mating edges prior to joining.
  - 2. Install seams and joints to prevent any direct paths which may allow water ingress.
  - 3. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
  - 4. The order of installation shall begin on the bottom of duct, sides, then top of ductwork.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.
  - 1. 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. Draw jacket tight and smooth.
    - b. 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.
    - c. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - d. On rectangular duct sides with dimensions 24 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 18 inches O.C.
    - e. On rectangular duct sides with dimensions larger than 24 inches, place pins 18 inches O.C. each way and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing. Provide pins and clip washers at 18" O.C. in the bottom of duct, minimum of 2 rows longitudinally.



- f. On round ductwork at 24" diameter and greater provide pins and clip washers at 18" O.C. in both directions from the horizontal centerline of duct downward.
  - g. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - h. Do not overcompress insulation during installation.
  - i. Impale insulation over pins and attach speed washers.
  - j. 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.
  - k. At all ductwork with external flanges, provide an 8" (min) piece of insulation wrapped around the duct, centered on the flange and securely taped.
  - l. Sagging duct insulation will not be acceptable.
  - m. Vapor retarders should overlap a minimum of two inches at all seams and be sealed with appropriate pressure sensitive tape. When applying pressure sensitive tapes, the tape must be firmly rubbed with the proper sealing tool to make sure the closure is secured. Follow tape manufacturers recommendations.
  - n. For below ambient services, apply vapor-barrier mastic over staples.
- 2. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 3. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- B. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
  - C. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
  - D. 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.
    - 1. 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.
    - 2. 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.
    - 3. 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.
    - 4. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches O.C.

- E. 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 50 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 all duct sides, space pins 12 inches O.C. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - b. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - c. Do not overcompress insulation during installation.
    - d. 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.
    - e. Vapor retarders should overlap a minimum of two inches at all seams and be sealed with appropriate pressure sensitive tape. When applying pressure sensitive tapes, the tape must be firmly rubbed with the proper sealing tool to make sure the closure is secured. Follow tape manufacturers recommendations.
  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. Tape and seal all ends and joints.
  7. Vapor retarders should overlap a minimum of two inches at all seams and be sealed with appropriate pressure sensitive tape. When applying pressure sensitive tapes, the tape must be firmly rubbed with the proper sealing tool to make sure the closure is secured. Follow tape manufacturers recommendations.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. 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.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches O.C. and at end joints.

### 3.8 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."

### 3.9 FINISHES

- A. Exposed insulation shall have paintable jacket material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
  - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- 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. Factory-insulated plenums and casings.
  - 4. Flexible connectors.
  - 5. Vibration-control devices.
  - 6. Factory-insulated access panels and doors.

### 3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round, supply-air, return-air and exhaust-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density with FSK jacket.
- B. Concealed, round, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density with FSK jacket.
- C. Concealed, rectangular, supply-air, return-air, and exhaust-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 2-lb/cu. ft. nominal density with FSK jacket.
- D. Concealed, rectangular, outdoor-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 2-lb/cu. ft. nominal density with FSK jacket.
- E. Concealed, rectangular, exhaust-air duct insulation from HRU-3 and between isolation dampers and penetration of building exterior shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 2-lb/cu. ft. nominal density with FSK jacket.
- F. Exposed, rectangular, supply-air and return-air duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density, with paintable ASJ jacket material.

- G. Exposed, rectangular, outdoor-air and exhaust-air duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 3 inches thick and 2-lb/cu. ft. nominal density, with paintable ASJ jacket material.
- H. Concealed, round, supply-air, return-air and exhaust-air duct insulation located in unconditioned space shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density with FSK jacket.
- I. Concealed, round, outdoor-air duct insulation located in unconditioned space shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density with FSK jacket.
- J. Concealed, rectangular, supply-air and return-air duct insulation located in unconditioned space shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 2-lb/cu. ft. nominal density with FSK jacket.
- K. Concealed, rectangular, outdoor-air duct insulation located in unconditioned space shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 2-lb/cu. ft. nominal density with FSK jacket.
- L. Exposed, round, supply-air and return-air duct insulation located in unconditioned space shall be the following:
  - 1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density with FSK jacket.
- M. Laboratory Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

### 3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Ducts and Plenums, Concealed:
  - 1. None.

### 3.14 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

END OF SECTION 230713

## SECTION 230716 - HVAC EQUIPMENT INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes insulating HVAC equipment that is not factory insulated.
- B. Related Sections:
  - 1. Section 230713 "Duct Insulation."
  - 2. Section 230719 "HVAC Piping Insulation."

#### 1.2 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).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail removable insulation at equipment connections.
  - 2. Detail application of field-applied jackets.
  - 3. Detail application at linkages of control devices.
  - 4. Detail field application for each equipment type.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program, certified by the Department of Labor, Bureau of Apprenticeship and Training.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include, the name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation, and maximum use temperature.

#### 1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.
- C. Coordinate installation and testing of heat tracing.

## 1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
  - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

### 2.2 INSULATION MATERIALS

- A. Products do not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- C. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- D. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
  - 1. Block Insulation: Type I.
  - 2. Special-Shaped Insulation: Type III.
  - 3. Board Insulation: Type IV.
  - 4. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
  - 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.3 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested in accordance with ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.4 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

## 2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  1. Width: 3 inches.
  2. Thickness: 11.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.6 SECUREMENTS

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.



### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, and jackets, of thicknesses required for each item of equipment, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- 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 storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
- 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 attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
  - 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 4 inches
  - 4. For below-ambient services, apply vapor-barrier mastic over staples.

5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
- L. Cut insulation in a manner to avoid compressing insulation.
- 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 in similar fashion to butt joints.
- O. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Glass-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive, anchor pins, and speed washers.
1. Apply adhesives in accordance with manufacturer's recommended coverage rates per unit area, for **50** percent coverage of tank and vessel surfaces.
  2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.
  4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints and 16 inches o.c. in both directions.
    - d. Do not compress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    - f. Impale insulation over anchor pins, and attach speed washers.
    - g. 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.
  5. Secure each layer of insulation with stainless steel or aluminum bands. Select band material compatible with insulation materials.

6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable and replaceable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

### 3.5 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.

### 3.6 FINISHES

- A. Equipment 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.

### 3.7 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. All insulation applications will be considered defective if they do not pass tests and inspections.

### 3.8 EQUIPMENT INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable 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 is Contractor's option.

### 3.9 INDOOR EQUIPMENT INSULATION SCHEDULE

- A. Insulate indoor and outdoor equipment that is not factory insulated.
- B. Steam-to-hot-water converter insulation is the following:
  - 1. Cellular Glass: 3 inches thick factory applied jacket.

END OF SECTION 230716

## SECTION 230718 – REFRIGERANT 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 HVAC piping systems:
  - 1. Condensate drain piping, indoors.
  - 2. Refrigerant suction, refrigerant liquid, and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "Duct Insulation."
  - 3. Division 23 Section "HVAC Piping Insulation Piping."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permence thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. 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.
- E. Field quality-control reports.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. 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 Division 23 Section "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.

## 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" and "Outdoor, Aboveground 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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
  - 2. Tubular and Factory slit with self-seal.
  - 3. Color: Black
  - 4. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 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.
  - 1. Small-Scale Environmental Chambers," including 2004 Addenda.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
  - 2. Insulation finish shall be the insulation manufacturers recommended finish.
  - 3. Adhesive shall be the insulation manufacturers recommended contract adhesives.
  - 4. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 5. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

## 2.3 SEALANTS

- A. Joint Sealants:
  - 1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.

## 2.4 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. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
  - 2. Adhesive: As recommended by jacket material manufacturer.

3. Color: 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.

## 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. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

### 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 insulation with longitudinal seams at top and bottom of horizontal runs.
- D. Install multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- 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. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- J. 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.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. 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 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.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 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. Install pipe insulation by sliding unslit sections over open ends of piping. Seal all seams and butt joints. It is unacceptable to field slit insulation sections for installation. Factory slit self seal tube insulation shall be provided for locations where slit tubes are required.
1. Insulation shall be pushed onto piping – never pulled.
  2. All edges shall be clean cut.

- C. Insulation Installation on Flanges and Fittings:
  - 1. All fittings shall be same thickness as adjacent piping.
- D. 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.
- 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.
  - 5. Openings in insulation that allow passage of air to surface being insulated.

### 3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where jackets for exterior use are indicated, install with 3-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  - 1. Utilizing stiff bristled brush or short pile fabric roller, brush adhesive or roll adhesive. Apply adhesive in a thin, uniform layer to both insulation surface and mating jacket surface. All overlapping joints shall be fully covered with adhesive on mating edges prior to joining.
  - 2. Install seams and joints to prevent any direct paths which may allow water ingress.
  - 3. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.7 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Do not field paint jackets.

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.
- B. Refrigerant Suction, Refrigerant Liquid, and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 2 inches thick.

### 3.10 OUTDOOR PIPING INSULATION SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Refrigerant Suction, Refrigerant Liquid, and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 2 inches thick with UV Resistant PVC Jacket.

END OF SECTION 230718

## SECTION 230719 - HVAC 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 HVAC piping systems:
  - 1. Heating hot-water piping, indoors.
  - 2. Condensate drain piping, indoors.
  - 3. Steam and condensate piping, indoors.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Equipment Insulation."
  - 2. Division 23 Section "Duct Insulation."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. 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.
- E. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. 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 Division 23 Section "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" and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. See "Product Characteristics" Article in Evaluations for comparisons and temperature ranges for insulation material properties.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. 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.

- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 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.
  - 1. Small-Scale Environmental Chambers," including 2004 Addenda.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 SEALANTS

- A. Joint Sealants:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
  - 5. Color: White or gray.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

## 2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.7 SECUREMENTS

- A. Bands:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with wing seal.
- B. Staples:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.
- C. Wire:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. 0.080-inch nickel-copper alloy.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.



- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at 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.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation 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, 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. 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 MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Membrane, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  - 1. Utilizing stiff bristled brush or short pile fabric roller, brush adhesive or roll adhesive. Apply adhesive in a thin, uniform layer to both insulation surface and mating jacket surface. All overlapping joints shall be fully covered with adhesive on mating edges prior to joining.
  - 2. Install seams and joints to prevent any direct paths which may allow water ingress.
  - 3. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.8 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.

- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
  - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
  - 2. NPS 2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 2 inch thick.
- B. Low Pressure Steam Supply and Condensate Return:
  - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
  - 2. NPS 2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 2 inch thick.
- C. Condensate Drain piping:
  - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
    - a. Closed Cell Elastomeric, Preformed Pipe, Type I: 1 inch thick

END OF SECTION 230719

## SECTION 230800 – COMMISSIONING OF HVAC

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. The purpose of this section is to specify Division 23 responsibilities in the commissioning process.
- B. The systems to be commissioned are listed in Section 019113.
- C. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 1. Division 23 shall be familiar with all parts of Division 1 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

#### 1.2 RESPONSIBILITIES

- A. Mechanical, Controls, and TAB Contractors (subcontractors). The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors (subcontractors) of Division 23 are as follows (all references apply to commissioned equipment only):

##### *Construction and Acceptance Phases*

1. Include and itemize the cost of commissioning in the contract price.
2. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, testing, O&M data and training.
3. Attend a commissioning kick-off meeting and other meetings necessary to facilitate the Cx process.
4. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.
5. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
  - a. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.
  - b. The Commissioning Authority may request further documentation necessary for the commissioning process.
  - c. This data request may be made prior to normal submittals.
6. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
7. Contractors/subcontractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
8. Provide limited assistance to the CA in preparing the specific functional performance test procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

9. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the Startup Checklists from the CA for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Section 019113 for further details on start-up plan preparation.
10. During the startup and initial checkout process, execute the mechanical-related portions of the Startup Checklists for all commissioned equipment.
11. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
12. Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
13. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
14. Provide skilled technicians to perform functional performance testing under the direction of the CA for specified. Assist the CA in interpreting the monitoring data, as necessary.
15. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, FR and A/E and retest the equipment.
16. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
17. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
18. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
19. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
20. Provide an Systems and Energy Management Manual consisting of the following:
  - a. Final as-built sequences of operation for all equipment
  - b. Procedures for seasonal start-up and shutdown, manual and reset operation
  - c. Final As-built control diagrams
  - d. Recommendations for recalibration frequency of sensors and actuators
  - e. List of all user-adjustable set points and reset schedules, with a discussion of the purpose of each and the range of reasonable adjustments with energy implications
  - f. List of time-of-day schedules
  - g. List of diagnostic tools, with description of their use, that will assist facility staff for the building in operating equipment more efficiently.

*Warranty Period*

1. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
  2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.
- B. Mechanical Contractor (Subcontractor). The responsibilities of the HVAC mechanical contractor (subcontractor), during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment, except for the building automation control system.
  2. Assist and cooperate with the TAB contractor and CA by:
    - a. Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
    - b. Including cost of sheaves and belts that may be required by TAB.
    - c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

- d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
  3. Install a P/T plug at each water sensor which is an input point to the control system.
  4. List and clearly identify on the as-built drawings the locations of all air-flow stations.
  5. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.
  6. Notify the FR or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the FR or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.
- C. Controls Contractor (Subcontractor). The commissioning responsibilities of the controls contractor (subcontractor), during construction and acceptance phases in addition to those listed in (A) are:
1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:
    - a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
    - b. All interactions and interlocks with other systems.
    - c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
    - d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).
    - e. Start-up sequences.
    - f. Warm-up mode sequences.
    - g. Normal operating mode sequences.
    - h. Unoccupied mode sequences.
    - i. Shutdown sequences.
    - j. Capacity control sequences and equipment staging.
    - k. Temperature and pressure control: setbacks, setups, resets, etc.
    - l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
    - m. Effects of power or equipment failure with all standby component functions.
    - n. Sequences for all alarms and emergency shut downs.
    - o. Seasonal operational differences and recommendations.
    - p. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
    - q. Schedules, if known.
    - r. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.



2. Control Drawings Submittal
  - a. The control drawings shall have a key to all abbreviations.
  - b. The control drawings shall contain graphic schematic depictions of the systems and each component.
  - c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
  - d. Provide a full points list with at least the following included for each point:
    - 1) Controlled system
    - 2) Point abbreviation
    - 3) Point description
    - 4) Display unit
    - 5) Control point or setpoint (Yes / No)
    - 6) Monitoring point (Yes / No)
    - 7) Intermediate point (Yes / No)
    - 8) Calculated point (Yes / No)

Key:

Point Description: DB temp, airflow, etc.

Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)

Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.

Calculated Point: "Virtual" point generated from calculations of other point values.

The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
4. Assist and cooperate with the TAB contractor in the following manner:
  - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
  - b. For a given area, have all required Startup Checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
  - c. Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

5. Assist and cooperate with the CA in the following manner:
    - a. Using a skilled technician who is familiar with this building, execute the functional testing of the controls system. Assist in the functional testing of all equipment specified in Section 019113. Provide two-way radios during the testing.
    - b. Execute all control system trend logs requested by the CA.
  6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Section 019113. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:
    - a. System name.
    - b. List of devices.
    - c. Step-by-step procedures for testing each controller after installation, including:
      - 1) Process of verifying proper hardware and wiring installation.
      - 2) Process of downloading programs to local controllers and verifying that they are addressed correctly.
      - 3) Process of performing operational checks of each controlled component.
      - 4) Plan and process for calibrating valve and damper actuators and all sensors.
      - 5) A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
    - d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.
    - e. A description of the instrumentation required for testing.
    - f. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB contractor for this determination.
  7. Provide a signed and dated certification to the CA and FR upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
  8. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified in the specifications and as indicated on the contract documents.
  9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).
- D. TAB Contractor (subcontractor) The duties of the TAB contractor (subcontractor) in addition to those listed in (A) are:
1. Six weeks prior to starting TAB, submit to the CA the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician on which was lead. The Owner will approve the site technician’s qualifications for this project.
  2. Submit the outline of the TAB plan and approach for each system and component to the CA, FR and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.
  3. The submitted plan will include:
    - a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
    - b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.

- c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
  - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
  - e. Final test report forms to be used.
  - f. Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.
  - g. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - h. Details of how *total* flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).
  - i. The identification and types of measurement instruments to be used and their most recent calibration date.
  - j. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.
  - k. Confirmation that TAB understands the outside air ventilation criteria under all conditions.
  - l. Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).
  - m. Details of how building static and exhaust fan / relief damper capacity will be checked.
  - n. Proposed selection points for sound measurements and sound measurement methods.
  - o. Details of methods for making any specified coil or other system plant capacity measurements.
  - p. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.
  - q. Details regarding specified deferred or seasonal TAB work.
  - r. Details of any specified false loading of systems to complete TAB work.
  - s. Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.
  - t. Details of any required interstitial cavity differential pressure measurements and calculations.
  - u. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
  - v. Plan for formal progress reports (scope and frequency).
  - w. Plan for formal deficiency reports (scope, frequency and distribution).
4. A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and FR at least twice a week.
  5. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
  6. Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

7. Provide the CA with any requested data, gathered, but not shown on the draft reports.
8. Provide a final TAB report for the CA with details, as in the draft.

### 1.3 RELATED WORK

- A. Refer to Section 019113 for systems to be commissioned and for functional testing requirements.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Division 23 shall provide all test equipment necessary to fulfill the testing requirements of this Division.
- B. Refer to Section 019113 for additional Division 23 requirements.

## PART 3 - EXECUTION

### 3.1 SUBMITTALS

- A. Division 23 shall provide submittal documentation relative to commissioning as required in this Section, Division 1 sections and Section 019113

### 3.2 STARTUP

- A. The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 019113. Division 23 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.
- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and FR. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all Startup Checklists as soon as possible.

### 3.3 TAB

- A. Refer to the TAB responsibilities in Part 1.2 above.

### 3.4 FUNCTIONAL PERFORMANCE TESTS

- A. Refer to Section 019113 for a list of systems to be commissioned and for a description of the process and for specific details on the required functional performance tests.

### 3.5 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

- A. Refer to Section 019113 for specific details on non-conformance issues relating to Startup Checklists and tests.
- B. Refer to Section 019113 for issues relating to functional performance tests.

### 3.6 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.
- B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the CO for inclusion in the O&M manuals, according to this section and Division 1 sections prior to the training of owner personnel.
- C. The CA shall receive a copy of the O&M manuals for review.
- D. Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.
  - 1. Three copies of the controls training manuals in a separate manual from the O&M manuals.
  - 2. Operation and Maintenance Manuals containing:
    - a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.
    - b. Full as-built set of control drawings (refer to Submittal section above for details).
    - c. Full as-built sequence of operations for each piece of equipment.
    - d. Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:
      - 1) Floor
      - 2) Room number
      - 3) Room name
      - 4) Air handler unit ID
      - 5) Reference drawing number
      - 6) Air terminal unit tag ID
      - 7) Heating and/or cooling valve tag ID
      - 8) Minimum cfm
      - 9) Maximum cfm
    - e. Full print out of all schedules and set points after testing and acceptance of the system.
    - f. Full as-built print out of software program.
    - g. Electronic copy on disk of the entire program for this facility.
    - h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
    - i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
    - j. Control equipment component submittals, parts lists, etc.
    - k. Warranty requirements.
    - l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
  - 3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
    - a. Sequences of operation
    - b. Control drawings
    - c. Points lists
    - d. Controller / module data
    - e. Thermostats and timers

- f. Sensors and DP switches
  - g. Valves and valve actuators
  - h. Dampers and damper actuators
  - i. Program setups (software program printouts)
- 4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.
- E. Special TAB Documentation Requirements. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the *Specifications*.
  - 1. Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.
  - 2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.
- F. Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA.

### 3.7. TRAINING OF OWNER PERSONNEL

- A. The CO shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 019113 for additional details.
- B. The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 019113 for additional details.
- C. Mechanical Contractor (Subcontractor). The mechanical contractor (subcontractor) shall have the following training responsibilities:
  - 1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 019113
  - 2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.
  - 3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
  - 4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
  - 5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
  - 6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
  - 7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

8. Training shall include:
  - a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
  - b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
  - c. Discussion of relevant health and safety issues and concerns.
  - d. Discussion of warranties and guarantees.
  - e. Common troubleshooting problems and solutions.
  - f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
  - g. Discussion of any peculiarities of equipment installation or operation.
  - h. The format and training agenda in *The HVAC Commissioning Process, ASHRAE Guideline 1-1989R*, 1996 is recommended.
  - i. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
9. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
10. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central control system.
11. Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.
12. Duration of Training. The mechanical contractor shall provide training on each piece of equipment according to the equipment specification sections and Division 1.
- D. Controls Contractor (Subcontractor). The controls contractor (subcontractor) shall have the following training responsibilities:
  1. Provide the CA with a training plan four weeks before the planned training according to the outline described in Section 019113.
  2. The controls contractor shall provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the control system.
  3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals *and* in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.
  4. The trainings will be tailored to the needs and skill-level of the trainees.
  5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.
  6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
  7. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

8. There shall be three training sessions:
  - a. Training I. Control System. The first training shall consist of **four** hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
  - b. Training II. Building Systems. The second session shall be held on-site for a period of **four** hours of actual hands-on training after the completion of system commissioning. The session shall include instruction on:
    - 1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
    - 2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
    - 3) All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
    - 4) Every screen shall be completely discussed, allowing time for questions.
    - 5) Use of keypad or plug-in laptop computer at the zone level.
    - 6) Use of remote access to the system via phone lines or networks.
    - 7) Setting up and changing an air terminal unit controller.
    - 8) Graphics generation
    - 9) Point database entry and modifications
    - 10) Understanding DDC field panel operating programming (when applicable)

- E. TAB The TAB contractor (subcontractor) shall have the following training responsibilities:
  1. TAB shall meet for three hours with facility staff after completion of TAB and instruct them on the following:
    - a. Go over the final TAB report, explaining the layout and meanings of each data type.
    - b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
    - c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
    - d. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
    - e. Other salient information that may be useful for facility operations, relative to TAB.

### 3.8. DEFERRED TESTING

- A. Refer to Section 019113 for general requirements of deferred testing.
- B. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.



### 3.9 WRITTEN WORK PRODUCTS

- A. Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 019113 and the filled out start-up, initial checkout and Startup Checklists.

END OF SECTION 230800

## SECTION 23 0923 - DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for complete building automation system (also identified as BMS, Direct Digital Control System For HVAC) including all necessary hardware and all operating and applications software as required for the complete performance of the Work, as shown on the Drawings, as specified herein.
- B. Related Sections: Related sections include, but shall not be limited to, the following:
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
  - 2. Applicable general requirements for electrical Work specified within Divisions 23, 26 Specification Sections apply to this Section.
- C. Network level components of the system – workstations, servers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2004. No gateways shall be used for communication to controllers furnished under this section.
- D. At a minimum, provide controls for the following:
  - 1. Hot Water (glycol) Loop Pumps
  - 2. Air Handling Units
  - 3. Air Handling Unit Condensing Units
  - 4. Variable Refrigerant Flow Systems with indoor valve kits.
  - 5. Unit Heaters
  - 6. Convectors
- E. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, Room Controllers, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.
- F. The BAS system supplier shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
- G. All interlocking wiring, wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. When the BAS system is fully installed and operational, the BAS system supplier and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the BAS system supplier shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
- H. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.

- I. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor, with guidance from the engineer, shall submit a proposal with appropriate modifications to the project to meet code restrictions. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.
- J. Related Sections
  - 1. This Section includes the Building Management System (BMS) control equipment for HVAC systems and components, including open protocol control components for terminal heating and cooling units. Depending on the scope of the project, the complete specification may have numerous sections that interface to this section, including several from Division 23 and 26.

## 1.2 REFERENCES

- A. General, Code Compliance: The code listed below form a part of this Specification to the extent referenced. The codes are referred to in the text by the basic designation only. The edition/revision of the referenced code shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
  - 1. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.
  - 2. All wiring shall conform to the National Electrical Code.
  - 3. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
  - 4. Comply with FCC, Part 68 rules for telephone modems and data sets.

## 1.3 DEFINITIONS

- A. Unless specifically defined within the Contract Documents, the words or acronyms contained within this specification shall be as defined within, or by the references listed within this specification, the Contract Documents, or, if not listed by either, by common industry practice.
  - 1. Standard
    - a. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
    - b. AHU: Air Handling Unit
    - c. BACnet: Building Automation Controls Network
    - d. BMS: Building Management System
    - e. DDC: Direct Digital Control
    - f. EIA: Electronic Industries Alliance
    - g. GUI: Graphical User Interface
    - h. HVAC: Heating, Ventilation, and Air Conditioning
    - i. IEEE: Institute Electrical Electronic Engineers
    - j. MER: Mechanical Equipment Room
    - k. PID: Proportional, Integral, Derivative
    - l. VAV: Variable Air Volume Box
  - 2. Communications and protocols
    - a. ARP: Address Resolution Protocol
    - b. BACnet: Building Automation and Control Networks
    - c. CORBA: Common Object Request Broker Architecture
    - d. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
    - e. DDE: Dynamic Data Exchange
    - f. FTP: File Transfer Protocol
    - g. FTT: Free Topology Transceivers
    - h. HTTP: Hyper Text Transfer Protocol

- i. IIOP: Internet Inter-ORB Protocol
  - j. IP: Internet Protocol
  - k. LAN: Local Area Network
  - l. LON: Echelon Communication – Local Operating Network
  - m. MS/TP: Master Slave Token Passing
  - n. OBIX: Open Building Information Exchange
  - o. ODBC: Open Database Connectivity
  - p. ORB: Object Request Broker
  - q. SNVT: Standard Network Variables Types
  - r. SQL: Structured Query Language
  - s. UDP: User Datagram Protocol
  - t. XML: eXtensible Markup Language
3. Controllers
- a. ASD: Application Specific Device
  - b. AAC: Advanced Application Controller
  - c. ASC: Application Specific Controller
  - d. CAC: Custom Application Controller
  - e. DCU: Distributed Control Unit
  - f. HRC: Hotel Room Controller
  - g. LCM: Local Control Module
  - h. MC: MicroControllers
  - i. MPC: Multi-purpose Controller
  - j. NSC: Network Server Controller
  - k. PEM: Package Equipment Module
  - l. PPC: Programmable Process Controller
  - m. RC: Room controller
  - n. RPC: Room Purpose Controller
  - o. SDCU: Standalone Digital Control Units
  - p. SLC: Supervisory Logic Controller
  - q. UEC: Unitary Equipment Controller
  - r. VAVDDC: Variable Air Volume Direct Digital Controller
4. Tools and Software
- a. AFDD: Automated Fault Detection and Diagnostic
  - b. APEO: Automated Predictive Energy Optimization
  - c. DR: Demand Response
  - d. CCDT: Configuration, Commissioning and Diagnostic Tool
  - e. BPES: BACnet Portable Engineering Station
  - f. LPES: LON Portable Engineering Station
  - g. POT: Portable Operator's Terminal
  - h. PEMS: Power and Energy Management Software
  - i. MTBF: Mean Time Between Failure

#### 1.4 SYSTEM DESCRIPTION

- A. In accordance to the scope of work, the system shall also provide a graphical, web-based, operator interface that allows for instant access to any system through a standard browser. The contractor must provide PC-based programming workstations, operator workstations and microcomputer controllers of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

- B. For this project, the system shall consist of the following components:
1. Administration and Programming Workstation(s): The BAS system supplier shall include Operation software and architecture as described in Part 2 of the specification. These workstations must be running the standard workstation software developed and tested by the manufacturer of the network server controllers and the standalone controllers. No third party front-end workstation software will be acceptable. Workstations must conform to the B-OWS BACnet device profile.
  2. Web-Based Operator Workstations: The BAS system supplier shall furnish licenses for web connection to the BAS system. Web-based users shall have access to all system points and graphics, shall be able to receive and acknowledge alarms, and shall be able to control setpoints and other parameters. All engineering work, such as trends, reports, graphics, etc. that are accomplished from the WorkStation shall be available for viewing through the web browser interface without additional changes. The web-based interface must conform to the B-OWS BACnet device profile. There will be no need for any additional computer based hardware to support the web-based user interface.
  3. Ethernet-based Network Router and/or Network Server Controller(s): The BAS system supplier shall furnish needed quantity of Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet at a minimum of 100mbps, and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network Server Controllers shall conform to BACnet device profile B-BC. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted. Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Building Controllers (B-BC).
  4. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control including air handlers, central plant control, and terminal unit control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment. Each BACnet protocol SDCU shall conform to the BACnet device profile B-AAC. BACnet SDCUs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Advanced Application Controllers (B-AAC).
- C. The Local Area Network (LAN) shall be either a 10 or 100 Mbps Ethernet network supporting BACnet, Modbus, XML and HTTPS for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.
- D. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.
- E. The system shall enable an open architecture that utilizes EIA standard 709.1, the LonTalk™ protocol and/or ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. Native support for the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol are required to assure that the project is fully supported by the HVAC open protocols to reduce future building maintenance, upgrade, and expansion costs.

- F. The system shall enable an architecture that utilizes a MS/TP selectable 9.6-76.8 KBAud protocol, as a common communication protocol between controllers and integral ANSI / ASHRAE™ Standard 135-2004, BACnet functionality to assure interoperability between all system components. The AAC shall be capable of communicating as a MS/TP device or as a BACnet IP device communicating at 10/100 Mbps on a TCP/IP trunk. The ANSI / ASHRAE™ Standard 135-2004, BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.
- G. LonTalk™ packets may be encapsulated into TCP/IP messages to take advantage of existing infrastructure or to increase network bandwidth where necessary or desired.
1. Any such encapsulation of the LonTalk™ protocol into IP datagrams shall conform to existing LonMark™ guide functionality lines for such encapsulation and shall be based on industry standard protocols.
  2. The products used in constructing the BMS shall be LonMark™ compliant.
  3. In those instances, in which Lon-Mark™ devices are not available, the BMS system supplier shall provide device resource files and external interface definitions for LonMark devices.
- H. The software tools required for network management of the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2004, BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. BACnet clients shall comply with the BACnet Operator Workstation (B-OWS) device profile; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP. Physical connection of LonWorks devices shall be via Ethernet IP or FTT-10A.
- I. The system shall provide support for Modbus TCP and RTU protocols natively, and not require the use of gateways.
- J. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of Mechanical Equipment Room (MER) valves and dampers and electronic actuation of terminal equipment valves and actuators as specified herein. The BMS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
1. The supplied system must incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs. The system shall not require JAVA to be enabled in the browser.
  2. Data shall reside on a supplier-installed server for all database access.
  3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network.

- K. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. The approved manufacturer's local field office shall have a minimum of 3 years of installation experience with the manufacturer and shall provide documentation in the bid and submittal package verifying longevity of the installing company's relationship with the manufacturer when requested. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 100 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.
- L. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC), Unitary Equipment Controllers (UEC) and VAV controllers (VAVDDC), monitoring all BACnet objects, monitoring overrides of all controller physical input/output points, and editing of controller resident time schedules.

## 1.5 SUBMITTALS

- A. General: Submittals shall be in accordance with the requirements of Section 01 33 00 Submittals and Section 23 00 10 Mechanical, in addition to those specified herein.
  - 1. All shop drawings shall be prepared in AutoCAD software. In addition to the drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.
  - 2. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.
  - 3. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
  - 4. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs. Diagrams shall be on 11" by 17" foldouts. If color has been used to differentiate information, the printed copies shall be in color.
  - 5. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor, prior to submitting, shall check all documents for accuracy.
  - 6. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.
  - 7. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as "As-Built".
    - a. System architecture drawing.
    - b. Layout drawing for each control panel
    - c. Wiring diagram for individual components
    - d. System flow diagram for each controlled system
    - e. Instrumentation list for each controlled system
    - f. Sequence of control
    - g. Binding map

- h. A matrix sheet detailing all system addresses and communication settings for the following:
      - 1) All IP network addresses & settings
      - 2) All BMS device addresses & communication settings
    - i. Operation and Maintenance Manuals
  - 8. Information common to the entire system shall be provided. This shall include but not be limited to the following.
    - a. Product manuals for the key software tasks.
    - b. Operating the system.
    - c. Administating the system.
    - d. Engineering the operator workstation.
    - e. Application programming.
    - f. Engineering the network.
    - g. Setting up the web server.
    - h. Report creation.
    - i. Graphics creation.
    - j. All other engineering tasks.
    - k. System Architecture Diagram.
    - l. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
    - m. Define the task.
    - n. Recommend a frequency for the task.
    - o. Reference the product manual that includes instructions on executing the task.
    - p. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
    - q. Licenses, guarantees, and warranty documents for equipment and systems.
    - r. Submit one copy for each building, plus two extra copies.
  - 9. Information common to the systems in a single building shall be provided.
    - a. System architecture diagram for components within the building annotated with specific location information.
    - b. As-built drawing for each control panel.
    - c. As-built wiring design diagram for all components.
    - d. Installation design details for each I/O device.
    - e. As-built system flow diagram for each system.
    - f. Sequence of control for each system.
    - g. Binding map for the building.
    - h. Product data sheet for each component.
    - i. Installation data sheet for each component.
    - j. Submit two copies for each building and two extra copies.
  - 10. Software shall be provided:
    - a. Submit a copy of all software installed on the servers and workstations.
    - b. Submit all licensing information for all software installed on the servers and workstations.
    - c. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
    - d. Submit all licensing information for all of the software used to execute the project.
    - e. All software revisions shall be as installed at the time of the system acceptance.
    - f. Firmware Files
    - g. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
    - h. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.



- i. Submit a copy of all application files that were created during the execution of the project.
- j. Submit a copy of all graphic page files created during the execution of the project.

## 1.6 QUALITY ASSURANCE

- A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 10 years.
  - 1. The Building Management System contractor shall have a full service facility within 50 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor's technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.
  - 2. Any installing contractor, not listed as prequalified in the Approved Manufacturer's section, shall submit credentials as detailed in the Pre-bid Submittal section for the engineer's review 2 weeks prior to bid date. Failure to follow the attached formats shall disqualify potential alternate bidders. Credentials must attest that the contractor meets all requirements of the specification and the Engineers judgment regarding approval to bid as an acceptable installer after reviewing the data will be final.
- B. All bidders must be authorized distributors or branch offices of the manufacturers specified.
- C. The following bidders have been pre-qualified:
  - 1. Schneider Electric – EcoStruxure
- D. Any installing contractors or manufacturers interested in participating as acceptable bidders for this project that are not pre-qualified shall furnish a detailed technical pre-bid submittal to the consulting engineer. All information must be submitted 2 weeks prior to the published bid date to allow the engineer adequate time to review the bidder's credentials.
- E. The Pre-Bid submittal shall contain the following information as a minimum:
  - 1. A profile of the manufacturer and the local installation and service/organization.
  - 2. Description of how the system meets and achieves all the specified criteria in terms of configuration, operation, and control.
  - 3. System Architecture with single line riser diagram showing all major components (digital controllers, routers, hubs, etc.) that will be required for this project.
  - 4. Procedure for commissioning and time required to startup and commission each of the systems for this project.
  - 5. Contractors approach for the project planning and management.
  - 6. Product Data Sheets for all components, DDC panels, and all accessories listed per the appropriate specification sections herein.
  - 7. Examples of actual graphic screens for other similar projects.
  - 8. Number and types of DDC panels required for this installation.
  - 9. Number and types of spare points provided with the proposed system.
  - 10. Recommended spare parts list for components with list price schedule.
  - 11. List of 2 similar systems in size, point capacity, total installed value, installed and commissioned by the local office with a list of the installers/manufacturers design team members for each project and the owners contact information.
  - 12. Samples of service offerings and a list of current similar service contracts with contact information.
  - 13. Resumes for the management team and all employees who will be involved with the project design, commissioning, project management, and after installation service. Resumes should include copies of manufacturer's certifications for the proposed product line.

14. Copy of this Control Specification in its entirety with a check mark beside each paragraph to signify that the manufacturer's equipment and software shall fully conform to the specified requirement. If the requirement cannot be met, indicate the reasons/limitations and the alternative proposed.
  15. An interview may be conducted and the bidder will be requested to make a formal presentation concerning the proposed system and possibly provide an installed project tour prior to a final decision.
- F. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.
- G. The BAS system supplier shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives. If the vendor is providing an AFDD/CC system, use of the analytics shall be used to help commission the system.
- H. The BAS system supplier shall provide a technician for 7 day manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS system supplier shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.
- I. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.
- J. Required elements of the startup testing include:
1. Measurement of voltage sources, primary and secondary
  2. Verification of proper controller power wiring.
  3. Verification of component inventory when compared to the submittals.
  4. Verification of labeling on components and wiring.
  5. Verification of connection integrity and quality (loose strands and tight connections).
  6. Verification of bus topology, grounding of shields and installation of termination devices.
  7. Verification of point checkout.
  8. Each I/O device is landed per the submittals and functions per the sequence of control.
  9. Analog sensors are properly scaled and a value is reported
  10. Binary sensors have the correct normal position and the state is correctly reported.
  11. Analog outputs have the correct normal position and move full stroke when so commanded.
  12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.
  13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
  14. Documentation of Loop tuning (sample rate, gain and integral time constant).

- K. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
  - 1. Graphics navigation.
  - 2. Trend data collection and presentation.
  - 3. Alarm handling, acknowledgement and routing.
  - 4. Time schedule editing.
  - 5. Application parameter adjustment.
  - 6. Manual control.
  - 7. Report execution.
  - 8. Automatic backups.
  - 9. Web Client access.
- L. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

#### 1.7 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor Control Centers," "Panel boards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.
- C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.
- D. Coordinate location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".
- E. Coordinate with the Owner's IT department on locations for NSC's, Ethernet communication cabling and TCP/IP addresses.

#### 1.8 OWNERSHIP

- A. The Owner shall retain licenses to software for this project.
- B. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition off this contractor. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer's license agreement, but shall protect the manufacturer's rights to disclosure of Trade Secrets contained within such software.
- C. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner's computers and only for the purpose of commissioning, servicing, or altering the installed system.
- D. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:
  - 1. Server and workstation software
  - 2. Application programming tools
  - 3. Configuration tools
  - 4. Network diagnostic tools
  - 5. Addressing tools
  - 6. Application files

7. Configuration files
8. Graphic files
9. Report files
10. Graphic symbol libraries
11. All documentation

#### 1.9 WORK BY OTHERS

- A. The BAS system supplier shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.
- B. The BAS system supplier shall furnish all Control Dampers, Control Valves, Flow Meters, Sensor Wells for installation by the Mechanical Contractor and/or others.
- C. The BAS system supplier shall provide field supervision to the designated contractor for the installation of the following:
  1. Automatic control dampers
  2. Blank-off plates for dampers that are smaller than duct size.
  3. Sheet metal baffles plates to eliminate stratification.
  4. The Electrical Contractor shall provide:
    - a. All 120VAC power wiring to motors, heat trace, junction boxes for power to BAS panels.
    - b. Furnish smoke detectors and wire to the building fire alarm system. HVAC Contractor to mount devices. BAS system supplier to hardwire to fan shut down.
    - c. Auxiliary contact (pulse initiator) on the electric meter for central monitoring of kWh and KW. Electrical Contractor shall provide the pulse rate for remote readout to the BAS. BAS system supplier to coordinate this with the electrical contractor.
- D. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.
- E. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.
- F. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

#### 1.10 WARRANTY

- A. All components, system software, and parts furnished and installed by the BMS system supplier shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BMS system supplier at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BMS system supplier shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:
  - 1. Direct Digital Control Systems Field Controller & Devices:
    - a. Schneider Electric EcoStruxure

### 2.2 ARCHITECTURE

- A. General
  - 1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
  - 2. An Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming, and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks.
  - 3. The Enterprise Level BAS shall support built-in reporting functionality without dependency on other software.
  - 4. The Enterprise Level BAS shall support standard accessing of data for third party reporting or analytics software.
  - 5. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.
  - 6. For Enterprise reporting capability and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be installed on a Microsoft Windows SQL based computer. The Reports Server can be installed on the same computer as the Enterprise Server.
  - 7. The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP, LonWorks IP, and/or Modbus TCP protocol.
- B. Modbus RTU/ASCII (and J-bus), Modbus TCP, BACnet MS/TP, BACnet IP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported.
- C. A sub-network of SDCUs using the BACnet IP protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.
- D. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.
- E. The fieldbus layer shall support all of the following types of SDCUs:
  - 1. BACnet IP SDCU requirements: The system shall consist of one or more BACnet/IP field buses managed by the Network Server Controller. The field bus layer shall consist of up to 50 IP SDCUs in daisy chain topology, or 39 if using RSTP, per layer, with a max of 5 sub networks in daisy chain for a total of 250 SDCUs or 6 sub networks in RSTP for a total of 234 SDCUs. The field bus layer shall consist ONLY of BACnet IP SDCUs. No other protocols, including BACnet MS/TP, shall be acceptable.

- F. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN). Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.
- G. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.
- H. System Expansion
  - 1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
  - 2. Web-based operation shall be supported directly by the NSCs and require no additional software.
  - 3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.
  - 4. The system shall be able to operate normally and without restriction at multiple software version levels with the only requirement that each element of the hierarchy be at least as new a version as the newest version in the level below it. In other words, Enterprise Servers will be able to manage NSCs of different version provided that the Enterprise Server was the same or more recent version than the most recent NSC version.
- I. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

## 2.3 OPERATOR WORKSTATION REQUIREMENTS

- A. General
  - 1. The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations, and one or more web-based operator workstations. For this project provide a minimum of 3 concurrent client licenses at the enterprise level. Client licenses are licenses that can be used for variable designations of the users choosing; i.e. operator, engineering, or web capabilities.
  - 2. The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC and/or Enterprise Server database.
  - 3. At the NSC level, there shall be no cap on concurrent web-based workstations (webstations) other than what the CPU capacity can support.
  - 4. All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.
  - 5. A minimum of 1 physical Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

B. Administration/Programming Workstation, and Webstation Requirements

1. The Workstation shall consist of the following:
  - a. Processor
    - 1) Minimum: Intel Core i5 @ 2.0 GHz or equivalent
    - 2) Recommended: Intel Core i5 @ 3.0 GHz or better
  - b. Memory
    - 1) Minimum: 4GB
    - 2) Recommended: 8GB or higher
  - c. Operating systems:
    - 1) Microsoft Windows 7 64-bit
    - 2) Microsoft Windows 10 64-bit
    - 3) Microsoft Windows Server 2012 R2 64-bit
    - 4) Microsoft Windows Server 2016
    - 5) Microsoft Windows Server 2019
  - d. 10/100MBPS Ethernet NIC
  - e. Storage
    - 1) Minimum: 20GB
    - 2) Recommended: 1TB
    - 3) Solid State Drive recommended
  - f. Required additional software:
    - 1) Microsoft .Net 4.7.2 and later
  - g. License agreement for all applicable software
2. Web-Based Operator PC Requirements
  - a. Any user on the network can access the system, using the following software:
  - b. Minimum:
    - 1) Google Chrome 61 or higher
    - 2) Mozilla Firefox 60 or higher
    - 3) Microsoft Edge (EdgeHTML) 16 or higher
    - 4) Safari 11.1 or higher
  - c. Recommended:
    - 1) Google Chrome 71 or higher
    - 2) Mozilla Firefox 64 or higher
    - 3) Microsoft Edge (EdgeHTML) 17 or higher
    - 4) Safari 11.4 or higher

C. General Administration and Programming Workstation Software

1. System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.
2. The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
3. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

D. User Interface:

1. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user’s “PC Desktop” – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.
2. System shall be able to automatically switch between displayed metric vs. imperial units based on the workstation/webstations localization.
3. The BMS workstation/webstations shall be capable of multiple language display, including English, Spanish, German, French, Japanese, Italian, Finnish, Portuguese, Swedish, Russian, and traditional and simplified Chinese. The multiple languages shall not require additional add on software from the standard workstation installer and shall be selectable within said workstation.
4. Webstations shall have the capability to automatically re-direct to an HTTPS connection to ensure more secure communications.
5. Personalized layouts and panels within workstations shall be extended to webstations to ensure consistent user experiences between the two user interfaces.
6. Webstations shall give the user the same capabilities within the graphics pages as are given within the workstation but shall be mobile responsive for use on smaller devices.
7. Servers and clients shall have the ability to be located in different time zones, which are then synchronized via the NTP server.
8. Workstation shall indicate at all times the communication status between it and the server.
9. The BMS web interface shall enable presentation mode whereby any functionality for interactivity shall be disabled.
10. The BMS web interface shall automatically detect light mode and dark mode settings in the operating system and adapt accordingly.
11. The BMS web interface shall allow override of the operating systems light/dark mode settings so that the setting can be enabled independent of the operating system’s setting.
12. The BMS web interface shall automatically respond and adapt to different screen sizes and orientations from smart phone to smart televisions of any size.
13. The BMS web interface shall support slideshow functionality.
14. The BMS web interface shall support full screen mode displaying Alarm views / graphics / dashboards / Custom Reports.

E. User Access and Permissions

1. The BMS system shall allow for creation of one account per user.
2. The BMS shall support Groups where User Accounts associated with the group can inherit group permissions.
3. The BMS shall be able to specify each user account / group accessibility to each object in the system.
4. The BMS permission system shall be possible to integrate with Windows Active directory.
5. The BMS shall be able to report on the permission level across account / group for review / archiving / audit.



6. This username/password combination shall be linked to a set of capabilities within the software, set and editable only by user with system administrator privileges. The sets of capabilities shall include: edit or View only, Acknowledge alarms, Enable/disable Program and change values.
7. The system shall allow the above capabilities to be applied independently to each and every class of object in the system.
8. The BMS shall support integration with Windows Active Directory for user log on credentials.
9. The BMS shall support configurable reminder for "Days until password expires".
10. The BMS shall support configurable password policy across:
  - a. Minimum number of characters
  - b. Minimum number of lowercase characters
  - c. Minimum number of numeric characters
  - d. Minimum number of special characters
  - e. Number of consecutive unique passwords before reuse
  - f. No more than three repeating identical characters
11. The BMS user account management shall support password policy with the following components:
  - a. Mandatory change of password at first logon with default credentials
  - b. Disabling of all imported user accounts by default
  - c. Custom password complexity rules and its enforcement
  - d. Custom password reuse and its enforcement
  - e. Configurable black listing of passwords to limit the use of common known passwords (e.g. password)
  - f. Password aging rules
12. The BMS shall be capable of enabling an anonymous access (guest account) to previously engineered views such as dashboards, graphics, etc. with configurable permissions and without username or password.
13. It shall be possible to configure the BMS system so that the guest account is used by default to simplify presentation of Kiosk Mode across multiple screens
14. The BMS shall provide time configurability to logout the user and to revert to a preconfigured presentation view, such as offered by the Guest account functionality.
15. The BMS shall provide configurability in managing access and permission levels based on location, IP addresses and address ranges, Schedule and Time of day and combination thereof.

F. Configuration Interface

1. The workstation software shall use a familiar Windows Explorer style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a "network map" of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.
2. The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created from the base object types within the system input, output, string variables, setpoints, etc., alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency. The system shall also maintain a link to all "child" objects created. If a user wishes to make a change to a parent object, the software shall ask the user if he/she wants to update all of the child objects with the change.

G. Color Graphic Displays

1. The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
2. Requirements of the color graphic subsystem include:
  - a. At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
  - b. The system shall support HTML5 enabled graphics.
  - c. It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
  - d. The editor shall use Scalable Vector Graphics (SVG) technology.
  - e. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, and graphs which can be “dropped” on a graphic through the use of a software configuration “wizard”. These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
  - f. Support for high DPI icons shall be included and automatically chosen if viewing on a high definition display such as Retina or 4K displays.
  - g. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
  - h. Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
  - i. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
  - j. It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
  - k. Graphics should rescale based on whatever monitor or viewing device is being used.
  - l. Be able to create graphics on varying layers that can be moved and repeated.
  - m. Be able to create graphics within varying window panes that can be moved and/or re-referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.
  - n. The ability to create re-usable cascading menus.
  - o. The ability to have multiple instances of a graphic and edit one instance to change all.
3. Additionally, the Graphics Editor portion of the Engineering Software shall provide the following capabilities:
  - a. Create and save pages.
  - b. Group and ungroup symbols.
  - c. Modify an existing symbol.
  - d. Modify an existing graphic page.
  - e. Rotate and mirror a symbol.
  - f. Place a symbol on a page.
  - g. Place analog dynamic data in decimal format on a page.
  - h. Place binary dynamic data using state descriptors on a page.
  - i. Create motion through the use of animated .gif files or JavaScript.
  - j. Place test mode indication on a page.
  - k. Place manual mode indication on a page.
  - l. Place links using a fixed symbol or flyover on a page.
  - m. Links to other graphics.

- n. Links to web sites.
  - o. Links to notes.
  - p. Links to time schedules.
  - q. Links to any .exe file on the operator work station.
  - r. Links to .doc files.
  - s. Assign a background color.
  - t. Assign a foreground color.
  - u. Place alarm indicators on a page.
  - v. Change symbol/text/value color as a function of an analog variable.
  - w. Change a symbol/text/value color as a function of a binary state.
  - x. Change symbol/text/value as a function of a binary state.
  - y. All symbols used by Schneider Electric EcoBuilding Business in the creation of graphic pages shall be saved to a library file for use by the owner.
- H. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.
- I. Alarm Management
- 1. The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
  - 2. Alarm management features shall include:
    - a. A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels.
    - b. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
    - c. At the Enterprise level the minimum number of active and viewable alarms shall be 10,000.
    - d. It shall be possible for the user to sort, filter and search on any available criteria such as priority, category, origin, alarm type, etc.
    - e. An active alarm viewer shall be included which can be customized for each user or user type to a hide or display any alarm attributes.
    - f. It shall be possible to present alarms with configurable colors based on priority, category, origin, alarm type, etc.
    - g. It shall be possible to linking files/documents/hyperlinks/navigation links/graphics link to an alarm for easy access upon occurrence
    - h. Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
    - i. Alarm notifications must support multiple distribution methods within one notification
    - j. On alarm, it shall be possible to notify via email to a preconfigured list of recipients . through a Simple Mail Transfer Protocol (SMTP) or secure email using Simple Mail Transfer Protocol Secure (SMTPS). No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
    - k. On alarm, it shall be possible to notify via SNMP
    - l. On alarm, it shall be possible to notify via file (on disk) that would be consumable by other alarm management services
    - m. An operator shall have the capability to assign an alarm to another user of the system.

- n. Individual alarms shall be able to be assigned to a user automatically via a preconfigured list of users and date/time. For example, a critical high temp alarm can be configured to be assigned to a Facilities Dept or to a Central Alarming workstation depending on time/date.
- o. Playing an audible sound on alarm initiation or return to normal.
- p. It shall be possible assigning a custom audio sound to each alarm / alarm-criteria ( priority, category, origin, alarm type, etc.)
- q. The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.
- r. The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to 'normal' and the quantity of disabled and hidden alarms.
- s. The alarm viewer can be configured to auto hide alarms when triggered.
- t. An operator shall have the capability to save and apply alarm favorites.
- u. Alarms shall be configurable such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
- v. Alarms shall be configurable such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
- w. It shall be possible to configure user-actions via user/group permissions when responding to an alarm
- x. All operator actions responding to an alarm must be audit trailed.

J. Static Paginated Reporting / Custom Reporting

- 1. The BMS Software and Network Servers shall support built-in native reporting capability without dependency on any external software
- 2. It shall be possible to generate custom reports manually, via Schedule, Alarm triggered or custom conditions (e.g. program/schedule/etc.)
- 3. The Custom Reporting shall have no dependency on external database
- 4. The Custom Reporting shall have the capability of reporting on the full range of available data, most recent to historical data.
- 5. It shall be possible to generate reports containing current active alarms
- 6. The Building Management System software shall natively be capable of producing custom repots in txt, xlxs and pdf file formats.
- 7. The Custom Report capability at the BMS software shall support digital signing of pdf for traceability and authenticity.

K. Dashboards

- 1. Dashboards shall provide rapid identification of real-time and historical trends, including energy use, operational efficiencies and critical metrics.
- 2. Using the Native Web Browser interface the system must allow for the selection, from a wide range of layouts and widgets (dashboard components), of items to create Dashboards
- 3. System must allow for dashboard view customization and selection of data points via the web browser and w/o any tools or prior training.
- 4. Built-in dashboards - A basic set of dashboard components shall be provided as part of the project. At a minimum, the following dashboard components functionality shall be provided for the Owner's use:
  - a. Resource Utilization
    - 1) This is used to illustrate the comparative consumption of a resource (like energy) over a flexible time period.
    - 2) The information is ordered by location and multiple locations may be plotted on the same columnar chart for clear analysis and comparison.

- b. Utility Performance Index
  - 1) This enables the creation and visualization of one or more Key Performance Index (KPI) charts for comparisons of resource utilization efficiencies for multiple locations.
  - 2) A typical use of this is in displaying a "scatter plot" of consumption (y-axis) versus consumption per unit area (x-axis).
  - 3) For example, an "Energy" KPI can be displayed by selecting the locations of interest (e.g. all Offices on Campus), selecting the vertical axis variable as Electric Consumption (kWh) and the horizontal axis as a "normalized" metric, such as "kWh per SFt".
- c. Real time Gauges
  - 1) Gauges allow the Owner to track values such as temperature, pressure, humidity and level in real time.
- d. Historical Gauges
  - 1) Gauges allow calculation of values based on historical data; for instance presenting max/min/average temperature/pressure/humidity over a given period
- e. Period over Period Comparison
  - 1) It shall be possible to visually compare historical data (e.g. temperature, energy, etc.) across multiple overlapping time periods (hours, days, weeks, etc.)
- 5. Custom dashboard components –
  - a. Custom dashboard components shall be able to present any information from the BMS (e.g. system health data, alarms, trends, events, user access, etc.)
  - b. The BMS shall allow creation of customized dashboard components in to presenting meaningful information as per customer

#### L. Scheduling

- 1. From the workstation or webstation, it shall be possible to configure and download schedules for any of the controllers on the network.
- 2. Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.
- 3. Schedules shall be programmable for a minimum of one year in advance.
- 4. To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.
- 5. Additionally, from the operator webstations, each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.
- 6. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.
- 7. It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.
- 8. It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.
- 9. It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.
- 10. It should accommodate a minimum of 16 priority levels.
- 11. Values should be able to be controlled directly from a schedule, without the need for special program logic.

M. Programmer's Environment

1. Programming in the NSC shall be either in graphical block format or line-programming format or both.
2. Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except, of course, the viewing of live tasks or values.
3. The programmer's environment will include access to a superset of the same programming language supported in the SDCUs.
4. NSC devices will support both script programming language as well as the graphical function block programming language. For both languages, the programmer will be able to configure application software for custom program development, and write global control programs. Both languages will have debugging capabilities in their editors.
5. It shall be possible to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.
6. The system shall be capable of creating 'custom types'. These types can be created within the programming environment, graphics, or as full controller 'templates' that can be pushed to any other variable pertaining to it to allow for singular reference to multiple objects. This allows easing of updating/changes allowing the use to make a singular change and push to all connected instances.
7. It shall be possible to view graphical programming live and real-time from the Workstation.
8. The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.
9. Key terms should appear when typing (IntelliType).
10. Applications should be able to be assigned different priorities and cycle times for a prioritized execution of different function.
11. The system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

N. Saving/Reloading

1. The workstation software shall have an application to save and restore NSC and field controller memory files.
2. For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.

O. Audit Trail

1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.
2. It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.
3. The Enterprise server shall be able to store up to 5 million events.
4. The event view shall support viewing of up to 100,000 events.
5. It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.
6. It shall be capable to search and view all forced values within the system.

- P. Fault Tolerant Enterprise Server Operation (Top level NSC)
1. A single component failure in the system shall not cause the entire system to fail. All system users shall be informed of any detectable component failure via an alarm event. System users shall not be logged off as a result of a system failure or switchover.
- Q. Web-based Operator Software
1. General:
    - a. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any part of the system from anywhere on the network.
    - b. The system shall be able to be accessed on site via a mobile device environment with, at a minimum, access to overwrite and view system values.
    - c. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
  2. Graphic Displays
    - a. The browser-based interface must share the same graphical displays as the Administration and Programming Workstations, presenting dynamic data on site layouts, floor plans, and equipment graphics. The browser's graphics shall support commands to change setpoints, enable/disable equipment and start/stop equipment.
    - b. Through the browser-based interface, operators must be able to navigate through the entire system, and change the value or status of any point in any controller. Changes are effective immediately to the controller, with a record of the change stored in the system database.
    - c. System shall have out-of-the-box dashboards that enable customizable views of live data which can be public to all users or capable to make them specific to a user based on log in credentials.
    - d. The user shall have the ability to create custom dashboards.
    - e. The dashboards shall have a kiosk mode which allows for occupant level data display on monitors or tablets throughout the building.
  3. Alarm Management
    - a. Systems requiring additional client software to be installed on a PC for viewing the webstation from that PC will not be considered.
    - b. Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation shall be presented, if the user's password allows it. Users must be able to receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text must be able to be added to the alarm record before acknowledgement, attachments shall be viewable, and alarm checklists shall be available.
- R. Groups and Schedules
1. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
  2. Through the browser interface, operators must be able to change schedules – change start and stop times, add new times to a schedule, and modify calendars.
- S. User Accounts and Audit Trail
1. The same user accounts shall be used for the browser interface and for the operator workstations. Operators must not be forced to memorize multiple passwords.
  2. All commands and user activity through the browser interface shall be recorded in the system's activity log, which can be later searched and retrieved by user, date, or both.

- T. Web Services
  - 1. The installed system shall be able to use web services to “consume” information within the Network Server/Controllers (NSCs) with other products and systems. Inability to perform web services within the NSCs will be unacceptable.
    - a. Shall be able to “consume” data into the system via SOAP and REST web services

## 2.4 NETWORK SERVER CONTROLLERS (NSC)

- A. Network Server Controllers shall combine both network routing functions, control functions, and server functions into a single unit.
- B. The BACnet NSC shall be classified as a “native” BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Network Server Controllers (B-BC).
- C. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.
- D. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.
- E. Whitelisting of file extensions for documents shall be capable.
- F. Encrypted and authenticated communication shall be configurable for non-open protocol communications using TLS 1.2.
- G. The NSCs shall support Simple Network Management Protocol version 3 (SNMPv3) for monitoring of the NSCs using a Network Management Tool.
- H. The NSCs shall support remote system logging for used by System Information and Event Monitoring (SIEM) software.
- I. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.
- J. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.
- K. It shall be capable of executing application control programs to provide:
  - 1. Calendar functions
  - 2. Scheduling
  - 3. Trending
  - 4. Alarm monitoring and routing
  - 5. Time synchronization by means of an Internet site including automatic synchronization
  - 6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data
  - 7. Network Management functions for all LonWorks based devices



L. Hardware Specifications

1. Memory:
  - a. The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
2. Each NRC shall provide the following on-board hardware for communication:
  - a. Two 10/100b Ethernet for communication to Workstations, other NRCs, IP field bus controllers, other SDCUs, and onto the internet.
    - 1) The two Ethernet ports shall support active switch and BACnet/IP communication protocols.
    - 2) Support IPv4 addressing
    - 3) Ethernet port 1 shall support static or DHCP client configuration for communication to Workstation or other NSCs
    - 4) Ethernet port 2 shall support switch mode or DHCP server to set addressing of DHCP client devices
    - 5) It shall be possible to disable Ethernet port 2
    - 6) In DHCP server mode, the Ethernet port 2 shall support 50 BACnet/IP field controllers in daisy chain configuration directly from the port
    - 7) Each NSC shall be able to support a total of 250 IP SDCUs in daisy chain configuration (5 sub networks via switch)
    - 8) If using RSTP (Rapid Spanning Tree Protocol) with a managed switch (with IEEE 802.1W or IEEE 802.1Q-2014 support), Ethernet port 2 shall support up to 39 devices
    - 9) Each NSC shall be able to support a total of 234 IP SDCUs in RSTP configuration (6 sub networks via managed switch)
    - 10) Where a switch is needed, use a Cisco 9000 Catalyst or IE switch, EtherWAN EX63402-01B, or other equal and approved equivalent.
  - b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
  - c. One TP/FT port for communication to LonWorks devices.
  - d. One device USB port
  - e. One host USB port
3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).

M. Modular Expandability:

1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
2. One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.
3. If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.

N. Hardware Override Switches:

1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

- O. Universal Input Temperatures
1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
    - a. 10 kohm Type I (Continuum)
    - b. 10 kohm Type II (I/NET)
    - c. 10 kohm Type III (Satchwell)
    - d. 10 kohm Type IV (FD)
    - e. Linearized 10 kohm Type V (FD w/11k shunt)
    - f. Linearized 10 kohm (Satchwell)
    - g. 1.8 kohm (Xenta)
    - h. 1 kohm (Balco)
    - i. 20 kohm (Honeywell)
    - j. 2.2 kohm (Johnson)
  2. In addition to the above, the system shall be capable of using the below RTD sensors, however it is not required that all universal inputs be compatible with them.
    - a. PT100 (Siemens)
    - b. PT1000 (Sauter)
    - c. Ni1000 (Danfoss)
- P. Local Status Indicator Lamps:
1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.
- Q. Real Time Clock (RTC):
1. Each NSC shall include a real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.
  2. The RTC date and time shall also be accurate, up to 10 days, when the NSC is powerless.
  3. No batteries may be used to for the backup of the RTC.
- R. Power Supply:
1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
  2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.
- S. Automatic Restart After Power Failure:
1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.
- T. Data Retention:
1. During a power failure, the NSC shall retain all programs, configuration data, historical data, and all other data that is configured to be retained. There shall be no time restriction for this retention and it must not use batteries to achieve it.

- U. Software Specifications
  - 1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
  - 2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.
- V. User Programming Language:
  - 1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.
  - 2. Network Server Controllers that use a “canned” program method will not be accepted.
- W. Control Software:
  - 1. The NSC shall have the ability to perform the following pre-tested control algorithms:
    - a. Proportional, Integral plus Derivative Control (PID)
    - b. Two Position Control
    - c. Digital Filter
    - d. Ratio Calculator
    - e. Equipment Cycling Protection
- X. Mathematical Functions:
  - 1. Each controller shall be capable of performing basic mathematical functions (+, -, \*, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.
- Y. NSCs shall have the ability to perform any or all of the following energy management routines:
  - 1. Time of Day Scheduling
  - 2. Calendar Based Scheduling
  - 3. Holiday Scheduling
  - 4. Temporary Schedule Overrides
  - 5. Optimal Start
  - 6. Optimal Stop
  - 7. Night Setback Control
  - 8. Enthalpy Switchover (Economizer)
  - 9. Peak Demand Limiting
  - 10. Temperature Compensated Duty Cycling
  - 11. CFM Tracking
  - 12. Heating/Cooling Interlock
  - 13. Hot/Cold Deck Reset
  - 14. Hot Water Reset
  - 15. Chilled Water Reset

16. Condenser Water Reset
17. Chiller Sequencing

Z. History Logging:

1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.
5. The presentation of logged data shall be built into the server capabilities of the NSC. Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.
6. Tooltips shall be present, magnetic, and visible based on users preference.
7. Comments shall be visible whenever viewing the trend log list.
8. System shall give indication of memory usage and be able to alert the user if too many logs are allocated.
9. The BMS software and Network Servers shall support recording of all historical data, independent of any limitation in its local memory, which will be readily available for reporting and analysis without additional configurations or actions.
10. All historical data shall be available for use by the operator to access in BMS or a third-party reporting systems.

AA. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.
5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.
6. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

BB. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.
2. The NSC shall be configurable to logging all Embedded Web Server access attempts
3. The NSC shall have the option to redirect HTTP based Embedded Web Server connections to secure, HTTPS connections.
4. The NSC shall authenticate and authorize all users connecting to the Embedded Web Server
5. The NSC shall provide to ability to configure an automatic logoff for Embedded Web Server users that have not had any activity for an adjustable time period.

CC. The NSC controller shall comply with the following regulatory certifications

1. CE – EN 61000-6-3
2. CE – EN 61000-6-2
3. CE – EN 61010-1
4. CE – EN 61326-1
5. FCC CFR 47 Part 15 Class A
6. RCM
7. RoHS 2011/65/EU
8. China RoHS SJ/T 11364-2014
9. UL916 Energy Management equipment

## 2.5 BACNET IP FIELDBUS CONTROLLERS

A. Controllers – BACnet/IP Protocol

1. All BACnet/IP Fieldbus controllers shall be BACnet Testing Laboratory listed (v12 or later) as specified BACnet Advanced Application Controller (B-AAC)
2. All BACnet/IP Fieldbus controllers shall use the following communication specifications and achieve performance as specified herein:
  - a. All controllers shall be able to communicate peer-to-peer without the need for a NSC
  - b. Any BACnet/IP Fieldbus controllers on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.

B. The BACnet/IP Fieldbus controllers shall be equipped with 2x 10/100bT Ethernet communication ports with active switch and will support BACnet/IP communication protocols with the following configurations:

1. Supporting IPv4 addressing
2. Supporting Static IP setting, DHCP client and Auto-IP address acquisition
3. It shall be possible to disable Ethernet port 2

C. Topologies

1. BACnet/IP Fieldbus controllers shall support daisy chain topology of up to 50 controllers. In case of any disruption to the communication, a system alarm shall notify the NSC/BMS of the point disruption has occurred.
2. BACnet/IP Fieldbus Controllers shall support RSTP loop whereby up to 39 controllers are supported.
  - a. In case of any disruption there shall be no communication interruption
  - b. In case of any disruption there shall be system alarms that will inform the operator of the disruption

D. Performance

1. Each BACnet/IP Fieldbus Controllers shall have a 32-bit microprocessor operating at 500 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2008 and the BACnet Device Profile supported.
2. They shall be multi-tasking, real-time digital control processors consisting of communication controllers, controls processing, power supplies with built-in inputs and outputs.

E. Programmability

1. The BACnet/IP Fieldbus controllers shall support both script programming language and graphical that will be consistent with the NSC.
2. The control program will reside within the same enclosure as the input/output circuitry, that reads inputs and controls outputs
3. All control sequences programmed into the BACnet/IP Fieldbus Controllers shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
4. BACnet/IP Fieldbus controllers shall communicate with the Network Server Controller (NSC) via a BACnet/IP connection at a baud rate of not less than 100 Mbps
5. BACnet/IP Fieldbus controllers shall support a dedicated communications port for connecting and supplying power to a matching room temperature and/or humidity sensor and/or CO2 and/or presence detector that does not utilize any of the I/O points of the controller.
6. BACnet/IP Fieldbus controllers (Excluding VAV) shall support an add-on display to supply and provide access in real-time for monitoring inputs and overriding of outputs
7. The override functionality must be supported by a dedicated processor to assure reliable operation (overriding of output)
8. Each BACnet/IP Fieldbus controller shall have sufficient memory, to support its own operating system and databases, including:
  - a. Control processes
  - b. Energy management applications
  - c. Alarm management
  - d. Historical/trend data
  - e. Maintenance support applications
  - f. Custom processes
  - g. Manal override monitoring
9. Each BACnet/IP Fieldbus controller shall support local trend data up to 2x the built-in I/O and at a minimum be capable of holding 5 days @ 15 min intervals locally.
10. The BACnet/IP Fieldbus controller analog or universal input shall use a 16 bit A/D converter.
11. The BACnet/IP Fieldbus controller analog or universal output shall use a 10 bit D/A converter.
12. Built-in I/O: each BACnet/IP Fieldbus controllers shall support:
  - a. At minimum 8 and up to 20 configurable IO channels to monitor and to control the following types of inputs and outputs without the addition of equipment inside or outside the DDC Controller cabinet.
    - 1) Universal Inputs – the following thermistors for use in the system without any external converters needed.
      - a) 10 kohm Type I (Continuum)
      - b) 10 kohm Type II (I/NET)
      - c) 10 kohm Type III (Satchwell)
      - d) 10 kohm Type IV (FD)
      - e) Linearized 10 kohm Type V (FD w/11k shunt)
      - f) Linearized 10 kohm (Satchwell)
      - g) 1.8 kohm (Xenta)
      - h) 1 kohm (Balco)
      - i) 20 kohm (Honeywell)
      - j) 2.2 kohm (Johnson)

- k) PT100 (Siemens)
    - l) PT1000 (Sauter)
    - m) Ni1000 (Danfoss)
  - 2) Analog inputs
    - a) Current Input - 0-20 mA
    - b) Voltage Input 0-10 Vdc
  - 3) Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
  - 4) Digital outputs
  - 5) Analog outputs of 4-20 mA and/or 0-10 Vdc
- 13. Real Time Clock (RTC):
  - a. Provide internal clocks for all BACnet Controllers (B-AAC) using BACnet time synchronization services.
    - 1) Automatically synchronize system clocks daily from an operator-designated controller.
    - 2) The system shall automatically adjust for daylight saving time.
  - b. Each BACnet/IP Fieldbus controller shall include a real time clock, accurate to +/-1 minute per month.
  - c. The RTC shall provide the following: time of day, day, month, year, and day of week.
  - d. The RTC date and time shall also be accurate up to 7 days, from when the BACnet/IP Fieldbus controller has lost power with no reliance on.
- 14. The BACnet/IP Fieldbus controller for Variable Air Volume (VAV) applications
  - a. The BACnet/IP Fieldbus controller for VAV applications shall include a built-in 'flow thru' differential pressure transducer
  - b. The VAV differential pressure transducer shall have a measurement range of 0 to 1 in. W.C. and measurement accuracy of  $\pm 5\%$  at 0.001 to 1 in. W.C. and a minimum resolution of 0.001 in. W.C., insuring primary air flow conditions shall be controlled and maintained to within  $\pm 5\%$  of setpoint at the specified minimum and maximum air flow parameters
  - c. The BACnet/IP FieldBus controller for VAV applications shall support a dedicated commissioning tool for air flow balancing
  - d. The BACnet/IP Fieldbus controller for VAV applications shall require no programing for air balancing algorithm
  - e. All balancing parameters shall be synchronized in NSC
- 15. Each BACnet/IP Fieldbus controller shall have a minimum of 10% spare capacity for each point type represented on the controller for future point connection
- 16. Power Requirements. 24VDC (21 to 33 VDC) and 24 VAC +/-20% with local transformer power
- 17. Each BACnet/IP Fieldbus controller shall be accredited for smoke control and smoke management within a fully IP control solution
- 18. The BACnet/IP Fieldbus controller shall comply with the following regulatory certifications
  - a. CE - EMCD 2014/30/EU
  - b. CE LVD 2014/35/EU
  - c. FCC CFR 47 Part 15 Class B
  - d. RCM
  - e. RoHS 2011/65/EU
  - f. China RoHS SJ/T 11364-2014
  - g. UL2043 (Plenum space mounting)
  - h. UL916 Open-Energy Management equipment
  - i. UL916 Energy Management equipment

19. Intelligent Space Sensor Interface –
  - a. The BACnet/IP Fieldbus controllers shall support a dedicated RJ45 communication port to communicate and power up to 4 intelligent wall mount sensors without the use of on-board inputs or outputs
  - b. It shall be possible to disable the RJ45 communication port.
20. The BACnet/IP Fieldbus controller for Connected Room solutions
  - a. All BACnet/IP Fieldbus controllers shall be BACnet Testing Laboratory listed (v14 or later) as specified BACnet Advanced Application Controller (B-AAC)
  - b. All BACnet/IP Fieldbus controllers shall use the following communication specifications and achieve performance as specified herein:
    - 1) All controllers shall be able to communicate peer-to-peer without the need for an NSC
    - 2) Any BACnet/IP Fieldbus controllers on the Ethernet Data Link/Physical layer shall be able to act as a Master to allow for the exchange and sharing of data variables and messages with any other controller connected on the same communication cabling. Slave controllers are not acceptable.
  - c. The BACnet/IP Fieldbus controllers shall be equipped with 2x 10/100bT Ethernet communication ports with active switch and will support BACnet/IP communication protocols with the following configurations:
    - 1) Supporting IPv4 addressing
    - 2) Supporting Static IP setting, DHCP client and Auto-IP address acquisition
    - 3) It shall be possible to disable Ethernet port 2
    - 4) Each BACnet/IP controller shall be configurable to restrict communications to only whitelisted IP addresses.
  - d. Topologies
    - 1) BACnet/IP Fieldbus controllers shall support daisy chain topology of up to 50 controllers. In case of any disruption to the communication, a system alarm shall notify the NSC/BMS of the point disruption has occurred.
    - 2) BACnet/IP Fieldbus Controllers shall support RSTP loop whereby up to 39 controllers are supported.
      - a) In case of any disruption there shall be no communication interruption
      - b) In case of any disruption there shall be system alarms that will inform the operator of the disruption
  - e. Performance
    - 1) Each BACnet/IP Fieldbus Controllers shall have a 32-bit microprocessor operating at 500 MHz and support a BACnet protocol stack in accordance with the ANSI/ASHRAE Standard 135-2012 and the BACnet Device Profile supported.
    - 2) They shall be multi-tasking, real-time digital control processors consisting of communication controllers, controls processing, power supplies with built-in inputs and outputs.
    - 3) Each BACnet/IP Fieldbus Controllers shall support upgrade of its firmware with no impact to its operation
  - f. Programmability
    - 1) The BACnet/IP Fieldbus controllers shall support both script programming language and graphical that will be consistent with the NSC.
    - 2) The control program will reside within the same enclosure as the input/output circuitry, that reads inputs and controls outputs
    - 3) All control sequences programmed into the BACnet/IP Fieldbus Controllers shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.



- 4) The BACnet/IP Fieldbus controllers shall communicate with the Network Server Controller (NSC) via a BACnet/IP connection at a baud rate of not less than 100 Mbps
- 5) The BACnet/IP Fieldbus controllers shall support two RS485 communication ports for connecting and supplying power to a range of protocol types
  - a) BACnet/IP Fieldbus controllers shall support configurable selection of the supported protocol on the RS485 communications ports,
  - b) BACnet/IP Fieldbus controllers shall support a communications capability for connecting and supplying power to a matching room temperature and/or humidity sensor and/or CO2 and/or presence detector that does not utilize any of the I/O points of the controller.
  - c) BACnet/IP Fieldbus controllers shall support a communications capability for connecting and supplying power to a matching connected module for the purpose of control of lights and blinds that do not utilize any of the I/O points of the controller
  - d) BACnet/IP Fieldbus controllers shall support a communications capability for connecting to open market Modbus devices
- g. BACnet/IP Fieldbus controllers shall support on-board Bluetooth Low Energy radio to support:
  - 1) Mobile application shall be available for controller commissioning
  - 2) Mobile applications shall be available for building occupants
  - 3) It shall be possible to disable the Bluetooth Low Energy Radio
  - 4) The BACnet/IP Fieldbus controller shall support a connection for an external antenna.
- h. BACnet/IP Fieldbus controllers shall support an optional plug-in Zigbee 3.0 radio for the purpose of connecting to wireless Zigbee sensors and devices.
  - 1) It shall be possible to connect to up to 16 Zigbee sensors or devices
  - 2) The controller shall support a range of different sensors and devices for easy commissioning
  - 3) The controller shall be able to connect to a Green Power Zigbee temperature and humidity sensor with 10 years of battery life
  - 4) The controller shall be able to connect to a Zigbee temperature, humidity and CO2 sensor with 10 years of battery life
- i. Controllers that only support older versions of the Zigbee 3.0 are not approved due to the lack of security layer
- j. It shall be possible to connect the Zigbee radio directly to the BACnet/IP RP Fieldbus controller.
- k. It shall be possible to install the Zigbee radio in the ceiling using a purpose designed extension cable and ceiling housing when radio reception at the controller may be compromised.
- l. Each BACnet/IP Fieldbus controller shall have sufficient memory, to support its own operating system and databases, including:
  - 1) Control processes
  - 2) Energy management applications
  - 3) Alarm management
  - 4) Historical/trend data
  - 5) Maintenance support applications
  - 6) Custom processes
- m. In the case of communication disruption between the BACnet/IP Fieldbus controller and NSC/BMS, each BACnet/IP Fieldbus controller shall support storage of local trend data up to 2x the number of its built-in I/O at the collection rate of 5 min for 5 days.

- n. The BACnet/IP Fieldbus controller analog or universal input shall use a 16-bit A/D converter.
- o. The BACnet/IP Fieldbus controller analog or universal output shall use a 10-bit D/A converter.
- p. Built-in I/O: each BACnet/IP Fieldbus controllers shall support:
  - 1) Up to 8 configurable IO channels to monitor and to control the following types of inputs and outputs without the addition of equipment inside or outside the DDC Controller cabinet.
    - a) Universal Inputs – the following thermistors for use in the system without any external converters needed.
    - b) 10K Ohm Type I (Continuum)
    - c) 10K Ohm Type II (I/NET)
    - d) 10K Ohm Type III (Satchwell)
    - e) 10K Ohm Type IV (FD)
    - f) Linearized 10K Ohm Type V (FD w/11k shunt)
    - g) Linearized 10K Ohm (Satchwell)
    - h) 1.8K Ohm (Xenta)
    - i) 1K Ohm (Balco)
    - j) 20K Ohm (Honeywell)
    - k) 2.2K Ohm (Johnson)
    - l) PT100 (Siemens)
    - m) PT1000 (Sauter)
    - n) Ni1000 (Danfoss)
    - o) Voltage Input - 0-10 Vdc
    - p) Digital inputs from dry contact closure, pulse accumulators, voltage sensing.
    - q) Digital outputs
    - r) Analog outputs 0-10 Vdc
- q. Internal Clock
  - 1) Provide internal clocks for all BACnet Controllers (B-AAC) using BACnet time synchronization services.
    - a) Automatically synchronize system clocks daily from an operator-designated controller.
    - b) The system shall automatically adjust for daylight saving time.
  - 2) Each BACnet/IP Fieldbus controller shall include a real time clock, accurate to +/-1 minute per month.
  - 3) The RTC shall provide the following: time of day, day, month, year, and day of week.
  - 4) The RTC date and time shall also be accurate up to 7 days, from when the BACnet/IP Fieldbus controller has lost power with no reliance on batteries
- r. Each BACnet/IP Fieldbus controller shall have a minimum of 10% spare capacity for each point type represented on the controller for future point connection
- s. Power Requirements. 24VDC (21 to 33 VDC) and 24 VAC +/-20% with local transformer power
- t. Power Requirements. A line voltage version shall be available 230 VAC
- u. In the case of power disruption, each BACnet/IP Fieldbus controller shall support power failure recovery within 10 seconds and resume operation from where the disruption had occurred
- v. The BACnet/IP Fieldbus controller shall be able to be plenum mounted (UL2043 compliant)
- w. The BACnet/IP Fieldbus controller shall meet the open class standard of UL916 permitting its installation without secondary enclosure where appropriate

- x. The BACnet/IP Fieldbus controller shall comply with the following regulatory certifications
  - 1) CE - EMCD 2014/30/EU
  - 2) CE LVD 2014/35/EU
  - 3) FCC CFR 47 Part 15 Class B
  - 4) RCM
  - 5) RoHS 2011/65/EU
  - 6) China RoHS SJ/T 11364-2014
  - 7) UL2043 (Plenum space mounting)
  - 8) UL916 Open-Energy Management equipment
  - 9) UL916 Energy Management equipment
- y. Intelligent Space Sensor Interface - The BACnet/IP Fieldbus controllers shall support an RJ45 communication port to communicate and power up to 4 intelligent wall mount sensors without the use of on-board inputs or outputs

## 2.6 DDC SENSORS AND POINT HARDWARE

### A. Temperature Sensors

1. Acceptable Manufacturers: Veris Industries, ACI Automation Components, Inc, Schneider Electric, Belimo, or approved equal.
2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of -30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
3. Room Sensor: Standard space sensors shall be available in an [off white][black] enclosure made of high impact ABS plastic for mounting on a standard electrical box. Basis of Design: Veris TW Series
  - a. Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
  - b. Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.
4. Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet. Basis of Design: Veris TD Series
5. Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing. Basis of Design: Veris TA Series
6. Pipe Immersion Sensor: Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Provide sensor probe length suitable for application. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications. Basis of Design: Veris TI Series
7. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series
8. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Wall Transmitter

1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, Schneider Electric, Belimo, or approved equal.
2. Transmitters shall be accurate to  $\pm 2\%$  at full scale.
3. Transmitter shall have replaceable sensing element.
4. Sensor type shall be thin-film capacitive.
5. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
6. Operating range shall be 0 - 100% RH noncondensing, 50 to 95 F
7. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC.
8. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
9. Transmitter shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box.
10. Transmitter shall have option of having an LCD display
11. Transmitter shall have option of being NIST certified
12. Transmitter shall have option of an integrated temperature sensor
13. Basis of Design: Veris HWL Series

C. Humidity Duct Transmitter

1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc., or approved equal.
2. Transmitters shall be accurate to  $\pm 2\%$  at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall have option of being NIST certified
11. Transmitter shall have option of an integrated temperature sensor
12. Basis of Design: Veris HD Series

D. Humidity Outdoor Transmitter

1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, Schneider Electric, Belimo, or approved equal.
2. Transmitters shall be accurate to  $\pm 2\%$  at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall have option of being NIST certified
11. Transmitter shall have option of an integrated temperature sensor
12. Basis of Design: Veris HO Series

- E. Carbon Dioxide Wall Transmitter:
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, Schneider Electric, Belimo, or approved equal.
  2. Sensor type shall be Non-dispersive infrared (NDIR).
  3. Accuracy shall be  $\pm 30$  ppm  $\pm 2\%$  of measured value with annual drift of  $\pm 10$  ppm. Minimum five year recommended calibration interval.
  4. Repeatability shall be  $\pm 20$  ppm  $\pm 1\%$  of measured value
  5. Response Time shall be  $< 60$  seconds for 90% step change
  6. Outputs shall be field selectable [Analog: 4-20mA or 0-5/0-10VDC][Protocol: Modbus or BACnet] with [SPDT Relay 1A@30VDC][temperature setpoint slider]
  7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
  8. Temperature Range: [32° to 122°F (CO2 only)][50° to 95°F (with humidity option)]
  9. Output range shall be programmable 0-2000 or 0-5000 ppm
  10. Transmitter shall be available in an off white enclosure for mounting on a standard electrical box.
  11. Transmitter shall have an option of an LCD display for commissioning and provide additional faceplate to conceal LCD display where occupants may misinterpret CO2 readings.
  12. Transmitter shall have option of an integrated temperature sensor and/or humidity sensor
  13. Basis of Design: Veris CWL
- F. Carbon Dioxide Duct Transmitter:
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, Schneider Electric, Belimo, or approved equal.
  2. Sensor type shall be Non-dispersive infrared (NDIR).
  3. Accuracy shall be  $\pm 30$  ppm  $\pm 2\%$  of measured value with annual drift of  $\pm 10$  ppm. Minimum five year recommended calibration interval.
  4. Repeatability shall be  $\pm 20$  ppm  $\pm 1\%$  of measured value
  5. Response Time shall be  $< 60$  seconds for 90% step change
  6. Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC with SPDT Relay 1A@30VDC
  7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
  8. Temperature Range: 32° to 122°F
  9. Output range shall be programmable 0-2000 or 0-5000 ppm
  10. Enclosure shall not require remote pickup tubes and make use of integrated H-beam probe to channel air flow to sensor.
  11. Enclosure lid shall require no screws and make use of snap on features for attachment
  12. Enclosure shall be made of high impact ABS plastic
  13. Transmitter shall have option of an LCD display
  14. Transmitter shall have option of an integrated temperature sensor and/or humidity sensor
  15. Basis of Design: Veris CDL
- G. Air Pressure Transmitters.
1. Acceptable Manufacturers: Veris Industries, ACI Automation Components, Inc., or approved equal.
  2. Sensor shall be microprocessor profiled ceramic capacitive sensing element
  3. Transmitter shall have 14 selectable ranges from 0.1 – 10" WC
  4. Transmitter shall be  $\pm 1\%$  accurate in each selected range including linearity, repeatability, hysteresis, stability, and temperature compensation.
  5. Transmitter shall be field configurable to mount on wall or duct with static probe
  6. Transmitter shall be field selectable for Unidirectional or Bidirectional
  7. Maximum operating pressure shall be 200% of design pressure.
  8. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC linear.
  9. Transmitter shall accept 12-30 VDC or 24 VAC supply power

10. Response time shall be field selectable T95 in 20 sec or T95 in 2 sec
  11. Transmitter shall have an LCD display
  12. Units shall be field selectable for WC or PA
  13. Transmitter shall have provision for zeroing by pushbutton or digital input.
  14. Transmitter shall be available with a certification of NIST calibration
  15. Basis of Design: Veris model PXU.
- H. Liquid Differential Pressure Transmitters:
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, or approved equal.
  2. Transmitter shall be microprocessor based
  3. Transmitter shall use two independent gauge pressure sensors to measure and calculate differential pressure
  4. Transmitter shall have 4 switch selectable ranges
  5. Transmitter shall have test mode to produce full-scale output automatically.
  6. Transmitter shall have provision for zeroing by pushbutton or digital input.
  7. Transmitter shall have field selectable outputs of 0-5V, 0-10V, and 4-20mA.
  8. Transmitter shall have field selectable electronic surge damping
  9. Transmitter shall have an electronic port swap feature
  10. Transmitter shall accept 12-30 VDC or 24 VAC supply power
  11. Sensor shall be 17-4 PH stainless steel where it contacts the working fluid.
  12. Performance:
    - a. Accuracy shall be  $\pm 1\%$  F.S. and  $\pm 2\%$  F.S. for lowest selectable range
    - b. Long term stability shall be  $\pm 0.25\%$
    - c. Sensor temperature operating range shall be  $-4^{\circ}$  to  $185^{\circ}\text{F}$
    - d. Operating environment shall be  $14^{\circ}$  to  $131^{\circ}\text{F}$ ; 10-90% RH noncondensing
    - e. Proof pressure shall be 2x max. F.S. range
    - f. Burst pressure shall be 5x max. F.S. range
  13. Transmitter shall be encased in a NEMA 4 enclosure
  14. Enclosure shall be white powder-coated aluminum
  15. Transmitter shall be available with a certification of NIST calibration
  16. Transmitter shall be preinstalled on a bypass valve manifold
  17. Basis of Design: Veris PW
- I. Current Sensors
1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturers are Veris Industries & Functional Devices
- J. Current Status Switches for Constant Load Devices
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, or approved equal.
  2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
  3. Visual LED indicator for status.
  4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.
  5. Normally open current sensor output. 0.1A at 30 VAC/DC.
  6. Basis of Design: Veris Model H608.

- K. Current Status Switches for Constant Load Devices (Auto Calibration)
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc, or approved equal.
  2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
  3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
  4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A
  5. Nominal Trip Point:  $\pm 40\%$ ,  $\pm 60\%$ , or on/off (user selectable)
  6. Normally open current sensor output. 0.1A at 30 VAC/DC.
  7. Basis of Design: Veris Model H11D.
- L. Current Status Switches for Variable Frequency Drive Application
1. Acceptable Manufacturer: Veris Industries, ACI Automation Components, Inc., or approved equal.
  2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
  3. Visual LED indicator for status.
  4. Alarm Limits:  $\pm 20\%$  of learned current in every 5 Hz freq. band
  5. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
  6. Normally open current sensor output. 0.1A at 30 VAC/DC.
- M. Water Control Valves
1. Ball Valves
    - a.  $\frac{1}{2}$ " to  $\frac{3}{4}$ " Ball Valve
      - i. Forged brass body rated at no less than 600 psi, chrome plated brass ball with blowout proof stem or optional stainless steel ball with blowout proof stem,
      - ii. Valves are to be in two-way and three-way configurations.
      - iii. Connection: Female NPT end fittings, Teflon® PTFE seat, characterizing disc glass filled PEEK providing equal percentage flow curve on two-way valve.
      - iv. Operating Temperature 20...250°F chilled or hot water with up to 60% glycol solution.
      - v. Two-way and Bypass port should be ANSI Class IV (0.01% of Cv) seat leakage.
      - vi. Rangeability must be at least 300:1.
      - vii. Tool-less actuator connection.
      - viii. System Static Pressure Limit should be 600 psig (4137 Pa)
      - ix. Acceptable Manufacturers: Schneider Electric, Belimo or approved equal.
- N. Dampers
1. Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS system supplier. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.
  2. Damper frames are to be constructed of 13 gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals and acetyl or bronze bearings shall also be provided.
  3. Damper blade width shall not exceed eight inches. Seals and  $\frac{3}{8}$  inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.

4. For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.
5. Control and smoke dampers shall be Ruskin, or approved equal.
6. Provide opposed blade dampers for modulating applications and parallel blade for two position control.

O. Damper Actuators

1. Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque.
2. Direct-coupled damper actuators must have a five-year warrantee.
3. Size for torque required for damper seal at maximum design conditions and valve close-off pressure for system design.
4. Direct-coupled damper actuators should accommodate 3/8", 1/2" 1.05" round or 3/8"...1/2" and 3/4" square damper shafts.
5. Actuator operating temperature minimum requirements: 44, 88 and 133 lb.-in. are -25°F...130°F (-32°C...55°C). The 30, 35, 60, 150 and 300 lb.-in. are -25°...140°F (-30°C... 60 °C). The 270 are -22°...122°F (-30°C... 50 °C).
6. Overload protected electronically throughout rotation except for selected Floating actuators the have a mechanical clutch.
7. Spring Return Actuators: Mechanical fail safe shall incorporate a spring-return mechanism.
8. Non-Spring Return Actuators shall stay in the position last commended by the controller with an external manual gear release to allow positioning when not powered.
9. Power Requirements: 24Vac/dc [120Vac][230Vac]
10. Proportional Actuators controller input range from 0...10 Vdc, 2...10 Vdc or 4...20 mA models.
11. Housing: Minimum requirement NEMA type 2 with NEMA type 4 available for applications requiring higher ratings.
12. Actuators with a microprocessor should not be able to be modified by an outside source (cracked or hacked).
13. Actuators of 133 and 270 lb.-in. of torque or more should be able to be tandem mount or "gang" mount.
14. Agency Listings: ISO 9001, cULus, CE and CSA
15. Acceptable Manufacturers: Schneider Electric, Belimo or approved equal.

P. Airflow Measuring Stations

1. Airflow measurement devices shall use the principle of thermal dispersion and provide one self-heated bead-in glass thermistor and one zero power bead-in-glass thermistor at each sensing node.
2. Thermal dispersion devices that indirectly heat a thermistor are not acceptable.
3. Acceptable Manufacturers: Ebtron, Inc. model GTx116-P+

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. In addition to the requirements specified herein, execution shall be in accordance with the requirements of Specification Section 23 00 00 and Drawings.
- B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.



- C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
  - D. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.
  - E. Install equipment in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
  - F. Provide final protection and maintain conditions in a manner acceptable to the manufacturer that shall help ensure that the equipment is without damage at time of Substantial Completion.
  - G. Demolition
    - 1. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.
  - H. Access to Site
    - 1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's Representative.
  - I. Code Compliance
    - 1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.
  - J. Cleanup
    - 1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.
- 3.2 SYSTEM ACCEPTANCE TESTING
- A. All application software will be verified and compared against the sequences of operation.
  - B. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
  - C. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
  - D. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.

- E. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

### 3.3 INSTALLATION

#### A. Hardware Installation Practices for Wiring

1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
2. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
3. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
4. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
5. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
6. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
7. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
9. Wire will not be allowed to run across telephone equipment areas.
10. Provide fire caulking at all rated penetrations.

#### B. Installation Practices for Field Devices

1. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
2. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
3. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
5. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
6. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

#### C. Wiring, Conduit, and Cable

1. All wire will be copper and meet the minimum wire size and insulation class listed below:
  - a. Power - 12 Gauge - 600 Volt
  - b. Class One - 14 Gauge Std. - 600 Volt
  - c. Class Two - 18 Gauge Std. - 300 Volt
  - d. Class Three - 18 Gauge Std. - 300 Volt
  - e. Communications - Per Mfr.

2. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
3. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
4. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
5. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
6. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
7. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
8. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.
9. Only glass fiber is acceptable, no plastic.
10. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS syste supplier shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

#### D. Enclosures

1. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
2. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
3. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
4. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
5. All outside mounted enclosures shall meet the NEMA-4 rating.
6. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

#### E. Identification

1. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
2. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
3. Junction box covers will be marked to indicate that they are a part of the BAS system.
4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
5. All I/O field devices inside FIP's shall be labeled.

F. Existing Controls.

1. Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.

G. Location

1. The location of sensors is per mechanical and architectural drawings.
2. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
3. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
4. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

H. Software Installation

1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

### 3.4 TRAINING

A. The BAS system supplier shall provide both on-site and classroom training to the Owner's representative and maintenance personnel per the following description:

B. On-site training shall consist of a minimum of (8) hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include

1. System Overview
2. System Software and Operation
3. System access
4. Software features overview
5. Changing setpoints and other attributes
6. Scheduling
7. Editing programmed variables
8. Displaying color graphics
9. Running reports
10. Workstation maintenance
11. Viewing application programming
12. Operational sequences including start-up, shutdown, adjusting and balancing.
13. Equipment maintenance

C. Factory, classroom training will include a minimum of (2) training reservations for a 3 day course with material covering workstation operation tuition free with travel expense responsibility of the owner. The option for 2-3 weeks of system engineering and controller programming shall be possible if necessary and desired.

### 3.5 DATABASE CONFIGURATION.

A. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

### 3.6 COLOR GRAPHIC DISPLAYS.

- A. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

### 3.7 POINT TO POINT CHECKOUT.

- A. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.
- B. In case of wireless devices, the signal strength recorded during checkout shall be reported.

### 3.8 CONTROLLER AND WORKSTATION CHECKOUT.

- A. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

### 3.9 DOCUMENTATION

- A. As built software documentation will include the following:
  - 1. Descriptive point lists
  - 2. Application program listing
  - 3. Application programs with comments.
  - 4. Printouts of all reports.
  - 5. Alarm list.
  - 6. Printouts of all graphics
  - 7. Commissioning and System Startup
  - 8. An electronic copy of all databases, configuration files, or any type of files created specifically for each system.

END OF SECTION 23 0923

## SECTION 230993 - SEQUENCES OF OPERATION FOR HVAC CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Section 230900 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

#### 1.3 DEFINITIONS

- A. BMS: Building Management System.

#### 1.4 EXHAUST FAN (EF) SEQUENCE OF OPERATION

- A. OCCUPIED:
  - 1. The exhaust fans will be enabled on a user determined occupancy scheduled schedule to enable when in occupied mode. All associated motorized dampers will open and the fan will enable and run continuous. The BMS shall monitor fan status.
  - 2. The operators work station will be able to manually override and disable the exhaust fans.
- B. UNOCCUPIED
  - 1. The exhaust fans will be disabled on a user determined occupancy schedule. All associated motorized dampers will close and the fan will be de-energized.
  - 2. The operators work station will be able to manually override and enable the exhaust fans. The exhaust fans will be interlocked with mechanical equipment providing outside air via the building management system. When the exhaust fans are enabled, mechanical equipment providing outside air will be placed in occupied mode.
- C. Alarms shall be generated on the operators work station for the following failures:
  - 1. Exhaust fan failure to enable.
  - 2. Exhaust fan status failure.
  - 3. Mechanical equipment interlock failure to enable.
  - 4. Motorized damper failure.

#### 1.5 CONSTANT VOLUME ROOFTOP UNITS WITH COOLING SEQUENCE OF OPERATION

- A. OCCUPIED MODE
  - 1. Operation: During the occupied mode, the supply fan shall be enabled and operate continuously, outside air, return air and exhaust air dampers shall open maintain minimum outside air flow requirements.
  - 2. Heating: The heating valve shall modulate open to maintain a space temperature of 72°F (adj.).

3. Mechanical Cooling – Outside Air Enthalpy Greater than Return air Enthalpy: When the outdoor air temperature is 55°F (adj.) or greater and the outside air enthalpy is greater than the return air enthalpy, the condensing unit shall be enabled and the compressors modulated and staged to maintain a space temperature of 78°F (adj.).
  - a. On a call for cooling, the controller shall activate the first stage of DX cooling. The first stage of cooling shall not shut down until the second stage has been disabled for at least 5 minutes.
  - b. If additional cooling is required, and the first stage has been running for at least 5 minutes, the controller shall activate the second stage of DX cooling.
  - c. When a cooling stage is called to run, it will run for at least 5 minutes.
  - d. When a cooling stage cycles off, it will remain off for at least 5 minutes.
4. Ventilation: The control system shall monitor the outside airflow through an airflow station. The control system shall monitor the exhaust airflow through an airflow station.

#### B. UNOCCUPIED MODE

1. Operation: The supply and exhaust fans shall be de-energized except when operation is called for as described below. Outside air dampers and exhaust dampers shall be closed and the unit shall de-energize.
2. Temperature Setback: The heating gas valve shall modulate to maintain a space temperature of 65°F (adjustable) until the space temperature is above the unoccupied setpoint + differential. The supply and return fan speed shall be controlled as described in the occupied mode. When the unoccupied heating space temperature setpoint + differential is reached, then the unit shall return to Unoccupied Off Mode.
3. Morning Warm-up: The optimum start program shall start the unit at the latest possible time to reach the desired occupied space temperature setpoint at occupancy time. If the average space temperature is below the occupied space temperature setpoint, the supply fan shall energize, the outside and exhaust dampers shall remain closed, the exhaust fan shall remain de-energized, and the return damper open. The heating coil valve shall modulate to maintain supply air temperature setpoint of 95°F (adjustable) until the average space temperature equals the occupied space temperature setpoint. The supply and return fan speed shall be controlled as described in the occupied mode. Morning warm-up shall occur only once in a day.

#### C. SAFETY SHUTDOWNS & ALARMS

1. Duct smoke detection, space smoke detection, shall de-energize the supply and exhaust fan and close the outside air and exhaust air dampers. Manual reset of the tripped device shall be required to restart the system.
2. A current sensor monitors the fan status to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.
3. A low limit (freezestat) temperature sensor monitors the supply air temperature after the duct furnace and is hardwired to the unit's fan starters. Upon detection of a supply air temperature below 35°F (adj.) the supply and return fan shall shut down, the outside air and exhaust air dampers shall close, and an alarm generated.
4. Low Mixed Air control: If the mixed air temperature is below 40°F (adj.), the outside air damper shall go to minimum position and a "Low Mixed Air Temperature" alarm provided.
5. Supply air temperature alarms shall be provided as follows:
  - a. High Supply Air Temp: If the supply air temperature is greater than 110°F (adj.).
  - b. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.)
6. A low limit (freezestat) temperature sensor monitors the discharge air temperature of the energy recovery wheel. Upon detection of supply air temperature below 35°F (adj.) the bypass damper shall open and an alarm generated.

- B. The unit will be interlocked with the fire alarm system. Upon activation of the fire alarm, the outside air damper will shut and the unit will disable. The unit will remain disabled until the fire alarm has been reset

## 1.6 AIR HANDLING UNIT (AHU) SEQUENCE OF OPERATION

### A. OCCUPIED MODE

1. Operation: During the occupied mode, the supply fan shall be enabled and operate continuously, outside air, return air and exhaust air dampers shall open maintain minimum outside air flow requirements.
2. Heating: When the outdoor air temperature is below 65°F (adj.) and the unit is in heating mode the unit will enable and maintain a discharge air temperature of 72 °F (adj.).
3. The heating mode shall be interlocked with the existing Variable Air Volume Boxes. When the Variable Air Volume boxes cannot maintain space temperature, the discharge air temperature shall reset higher until the space temperature setpoint can be maintained.
4. Ventilation: Will be provided and set to the minimum airflow rate per the balancing agent per the ventilation schedules.
5. Cooling:
  - a. Economizer cooling: When the outdoor air temperature is below 65°F (adj.) the space calls for cooling the outside air damper shall modulate open to maintain the space temperature setpoint. If the outside air damper is modulated fully open the outside air temperature is above 65°F (adj.) and the relative humidity is above 60% the mechanical cooling system will enable. The outside air damper will modulate to its minimum outside air setpoint and the mechanical cooling sequence will begin.
  - b. Mechanical Cooling – Outside Air Enthalpy Greater than Return air Enthalpy: When the outdoor air temperature is 65°F (adj.) or greater and the outside air enthalpy is greater than the return air enthalpy, the condensing unit shall be enabled and the compressors modulated and staged to maintain a discharge temperature set point.
    - 1) On a call for cooling, the controller shall activate the first stage of DX cooling. The first stage of cooling shall not shut down until the second stage has been disabled for at least 5 minutes.
    - 2) If additional cooling is required, and the first stage has been running for at least 5 minutes, the controller shall activate the second stage of DX cooling.
    - 3) When a cooling stage is called to run, it will run for at least 5 minutes.
    - 4) When a cooling stage cycles off, it will remain off for at least 5 minutes.

### B. UNOCCUPIED MODE

1. Operation: The supply fans shall be de-energized. Outside air dampers and exhaust dampers shall be closed and the unit shall de-energize. During the occupied mode, the supply fan shall be enabled and operate continuously, outside air, return air and exhaust air dampers shall open maintain minimum outside air flow requirements. A pressure sensor shall be located 2/3rds down ductwork and the supply fan shall modulate to maintain constant pressure.
2. Heating Temperature Setback: Space temperature shall be controlled by the gas heat. When the space falls below the setback temperature of 65°F (adj.) the gas heat section shall enable and the supply and return fans associated with the heat recovery unit shall energize.



3. Heating: When the outdoor air temperature is below 65°F (adj.) the modulating gas valve shall be enabled to maintain a discharge air temperature set point of 72°F (adj.)
4. Morning Warm-up: The optimum start program shall start the unit at the latest possible time to reach the desired occupied space temperature setpoint at occupancy time. The supply and return fan speed shall be controlled as described in the occupied mode. Morning warm-up shall occur only once in a day.

C. SAFETY SHUTDOWNS & ALARMS

1. A current sensor monitors the fan status to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from BMS start/stop control.
2. A low limit (freezestat) temperature sensor monitors the supply air temperature after 3-way valve modulates open. Upon detection of a supply air temperature below 35°F (adj.) the supply and return fan shall shut down, the outside air and exhaust air dampers shall close, and an alarm generated.
3. Low Mixed Air control: If the mixed air temperature is below 40°F (adj.), the outside air damper shall go to minimum position and a “Low Mixed Air Temperature” alarm provided.
4. Supply air temperature alarms shall be provided as follows:
  - 1) High Supply Air Temp: If the supply air temperature is greater than 110°F (adj.).
  - 2) Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).
5. A low limit (freezestat) temperature sensor monitors the discharge air temperature of the energy recovery wheel. Upon detection of supply air temperature below 38°F (adj.) the bypass damper shall open and an alarm generated.

1.7 EXISTING VARIABLE AIR VOLUME (VAV) BOXES

A. OCCUPIED MODE

1. Heating: The air terminal shall modulate air volume to maintain 72°F (adj.) at space thermostat.
2. Cooling: The damper will modulate to maintain a space temperature of 78°F (adj.).

B. UNOCCUPIED MODE

1. Heating: The air terminal shall modulate air volume to maintain the setback temperature of 65°F (adj.) at space thermostat.
2. Cooling: The damper will modulate to maintain a space temperature of 84°F (adj.).

C. SAFETY SHUTDOWNS & ALARMS

1. A low limit temperature alarm will notify the operators work station if the space temperature cannot maintain space temperature set point +differential in the heating mode.
2. A high limit temperature alarm will notify the operators work station if the space temperature cannot maintain the space temperature set point + differential in the cooling mode.

## 1.8 CABINET UNIT HEATERS (CUH) SEQUENCE OF OPERATION

The occupancy mode (Occupied or Unoccupied) shall be determined through a user-adjustable, graphical, seven-day schedule with an additional holiday schedule.

- A. Occupied Mode
  - 1. On a call for heating, the steam valve will modulate to maintain space temperature set point, 72°F (adj.), and the supply fan will energize.
- B. Unoccupied Mode
  - 1. On a call for heating, the steam heating valve will modulate to maintain the space unoccupied setback temperature setpoint, 65°F (adj.), and the supply fan will energize.
- C. Low temperature alarm shall be indicated on the operators work station.

## 1.9 UNIT HEATERS (UH) SEQUENCE OF OPERATION

The occupancy mode (Occupied or Unoccupied) shall be determined through a user-adjustable, graphical, seven-day schedule with an additional holiday schedule.

- A. Occupied Mode
  - 1. On a call for heating, the hydronic heating valve will modulate to maintain space temperature set point, 72°F (adj.), and the supply fan will energize.
- B. Unoccupied Mode
  - 1. On a call for heating, the hydronic heating valve will modulate to maintain the space unoccupied setback temperature setpoint, 65°F (adj.), and the supply fan will energize.
- C. Low temperature alarm shall be indicated on the operators work station.

## 1.10 FIN TUBE (FT) SEQUENCE OF OPERATION

The occupancy mode (Occupied or Unoccupied) shall be determined through a user-adjustable, graphical, seven-day schedule with an additional holiday schedule.

- A. Occupied Mode
  - 1. On a call for heating, the steam heating valve will modulate to maintain space temperature set point, 72°F (adj.).
- B. UNOCCUPIED MODE
  - 1. On a call for heating, the steam heating valve will modulate to maintain the space unoccupied setback temperature setpoint, 65°F (adj.).
- C. Low temperature alarm shall be indicated on the operators work station

## 1.11 UNIT VENTILATOR (UV) SEQUENCE OF OPERATION

- A. OCCUPIED MODE:
  - 1. Run Conditions - Scheduled: The unit shall run according to a user definable time schedule in the following modes:
    - a. Occupied Mode: The unit shall maintain
      - 1) A 70°F (adj.) heating setpoint.
      - 2) Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating setpoints at the zone sensor

2. Fan: The fan shall run anytime the unit is commanded to run, unless shutdown on safeties. The controller shall monitor the fan status. An alarm shall be provided for a fan commanded on, but the status is off.
3. Face and Bypass Dampers Control: When the outdoor air temperature is below the low OA temperature setpoint, 37 deg F,( adj.), the heating coil valve will be fully opened and the face and bypass dampers will be used to maintain zone temperature setpoint. When the Outdoor Air Temperature is above the low OA temperature setpoint, the face and bypass damper will open fully to the coil and the heating coil will be used to maintain the zone temperature setpoint. The unit shall maintain zone heating and cooling setpoints by modulating the face and bypass dampers through one of the following:
  - a. Heating:
    - 1) When the zone temperature is less than the heating setpoint, the face and bypass dampers shall modulate open to face position (closed to bypass position) to maintain setpoint by modulating the air passing over the heating coil.
    - 2) When the zone temperature is greater than the heating setpoint, the face and bypass dampers shall close to face position (open to bypass position).
4. Steam Coil Valve: The controller shall measure the zone temperature and open the heating coil valve to maintain its heating setpoint.
5. Cooling Coil: The BMS shall monitor the space temperature cooling set point and enable the outdoor air cooled condensing unit.
  - a. Mechanical Cooling – Outside Air Enthalpy Greater than Return air Enthalpy: When the outdoor air temperature is 55°F (adj.) or greater and the outside air enthalpy is greater than the return air enthalpy, the condensing unit shall be enabled and the compressors modulated and staged to maintain a discharge temperature set point.
    - 1) On a call for cooling, the controller shall activate the DX cooling.
    - 2) When a cooling stage is called to run, it will run for at least 5 minutes.
    - 3) When a cooling stage cycles off, it will remain off for at least 5 minutes.
  - b. The heating shall be enabled whenever:
  - c. Outside air temperature is less than 65°F (adj.).
  - d. AND the zone temperature is below heating setpoint.
  - e. AND the fan is on.
6. The heating coil valve shall open whenever the freezestat (if present) is on.
7. Economizer (ASHRAE Cycle II): Economizer suitability will be determined by a dry bulb comparison of the outdoor air and the economizer setpoint 65 deg F, (adj.). Upon a rise in zone temperature, the cooling coil will be used to maintain zone temperature setpoint. When the low limit temperature switch is in alarm, the damper will be commanded to close. The controller shall measure the zone temperature and modulate the mixed air dampers in sequence to maintain the zone cooling setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open during heating and ventilation whenever occupied.
  - a. The economizer shall be enabled whenever:
    - 1) Outside air temperature is at least 3°F (adj.) less than the Zone Temperature.
    - 2) AND the outside air temperature is less than 75°F (adj.)
  - b. The economizer shall close whenever the freezestat (if present) is on.
  - c. The outside air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

- d. The controller shall monitor the discharge air temperature. Should discharge temperature drop below a user definable temperature (adj.), the controller shall enable the heating, close the outside damper and open the return damper.
  - e. Minimum Outside Air Ventilation - Fixed Percentage: The outside air dampers shall maintain a minimum position (adj.) during building occupied hours and be closed during unoccupied hours.
8. Discharge Air Temperature: The controller shall monitor the discharge air temperature.

**B. UNOCCUPIED MODE:**

- 1. Run Conditions - Scheduled: The unit shall run according to a user definable time schedule in the following modes:
  - a. Unoccupied Mode (night setback): The unit shall maintain
    - 1) A 55°F (adj.) heating setpoint.
    - 2) Zone Setpoint Adjust: The occupant shall be able to adjust the zone temperature heating setpoints at the zone sensor
- 2. Zone Unoccupied Override: A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

**C. Alarms shall be provided as follows:**

- 1. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).
- 2. Freeze Protection: The unit shall shut down and generate an alarm upon receiving a freezestat status.
- 3. High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).
- 4. Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

**1.12 DUCTLESS SPLIT SYSTEMS (DSS) SEQUENCE OF OPERATION**

**A. The VRF system shall include factory provided control with BACnet interface for scheduling and monitoring by the BMS.**

**B. OCCUPIED MODE**

- 1. Heating: air cooled condensing unit shall remain disabled and the indoor evaporator unit shall enable the fan only.
- 2. Cooling: the air cooled condensing unit and associated indoor evaporator units shall enable. The supply fan associated with the indoor evaporator units shall enable. The VRF system shall modulate to maintain the space temperature setpoint of 72°F (adj.)
  - a. Mechanical Cooling – Outside Air Enthalpy Greater than Return air Enthalpy: When the outdoor air temperature is 65°F (adj.) or greater and the outside air enthalpy is greater than the return air enthalpy, the condensing unit shall be enabled and the compressors modulated and staged to maintain a discharge temperature set point.
    - 1) On a call for cooling, the controller shall activate the first stage of DX cooling. The first stage of cooling shall not shut down until the second stage has been disabled for at least 5 minutes.
    - 2) If additional cooling is required, and the first stage has been running for at least 5 minutes, the controller shall activate the second stage of DX cooling.
    - 3) When a cooling stage is called to run, it will run for at least 5 minutes.
    - 4) When a cooling stage cycles off, it will remain off for at least 5 minutes.
    - 5) The supply fan associated with the indoor unit shall enable and

C. UNOCCUPIED MODE:

1. Heating: air cooled condensing unit shall remain disabled and the indoor evaporator unit shall be disabled.
2. Cooling: the air cooled condensing unit and associated indoor evaporator units shall enable. The supply fan associated with the indoor evaporator units shall enable. The VRF system shall modulate to maintain the space temperature setpoint of 72°F (adj.)
  - a. Mechanical Cooling – Outside Air Enthalpy Greater than Return air Enthalpy: When the outdoor air temperature is 65°F (adj.) or greater and the outside air enthalpy is greater than the return air enthalpy, the condensing unit shall be enabled and the compressors modulated and staged to maintain a discharge temperature set point.
    - 1) On a call for cooling, the controller shall activate the first stage of DX cooling. The first stage of cooling shall not shut down until the second stage has been disabled for at least 5 minutes.
    - 2) If additional cooling is required, and the first stage has been running for at least 5 minutes, the controller shall activate the second stage of DX cooling.
    - 3) When a cooling stage is called to run, it will run for at least 5 minutes.
    - 4) When a cooling stage cycles off, it will remain off for at least 5 minutes.
    - 5) The supply fan associated with the indoor unit shall enable and
3. Ventilation shall be disabled during unoccupied modes.

D. SAFETY SHUTDOWNS & ALARMS

1. A current sensor monitors the fan status to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from BMS start/stop control.
2. Supply air temperature alarms shall be provided as follows:
  - a. High Supply Air Temp: If the supply air temperature is greater than 110°F (adj.).
  - b. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.)

1.13 ROOF VENTILATOR INTAKE/RELIEF (RVI/RVR) SEQUENCE OF OPERATION

A. OCCUPIED:

1. All associated motorized dampers will open and the BMS shall monitor damper position.

B. UNOCCUPIED

1. All motorized dampers will close.

C. Alarms shall be generated on the operators work station for the following failures:

1. Motorized damper failure.

1.14 VENTILATION SEQUENCES

- A. Combustion-Air, Makeup Unit Control, Electric: Start fan when served appliance burner starts; room thermostat sequences stages of heating.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

## SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Hot Water heating-water piping.
  - 2. Blowdown-drain piping.
  - 3. Air-vent piping.
  - 4. Safety-valve-inlet and -outlet piping.
- B. Related Sections include the following:
  - 1. Section 232123 "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

#### 1.3 DEFINITIONS

- A. PTFE: Polytetrafluoroethylene.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Heating-Water Piping: 100 psig at 210 deg F.
  - 2. Blowdown-Drain Piping: 200 deg F.
  - 3. Air-Vent Piping: 200 deg F.
  - 4. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Plastic pipe and fittings with solvent cement.
  - 2. RTRP and RTRF with adhesive.
  - 3. Pressure-seal fittings.
  - 4. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 5. Air control devices.
  - 6. Chemical treatment.
  - 7. Hydronic specialties.

- B. Shop/Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at  $\frac{1}{4}" = 1'-0"$  scale, double lined. Drawings shall indicate duct and pipe layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items and trades involved: (Submit 3 hard copies of all documents to Architect for Review and Approval):
1. Duct and piping installation in all spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct and piping layout.
  2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  3. Fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides.
  4. Detail location of anchors, alignment guides, and expansion joints and loops.
  5. Factory- and shop-fabricated ducts and fittings.
  6. Duct layout indicating sizes, configuration, liner material, static-pressure class, and service.
  7. Piping layout indicating sizes, configuration, and service.
  8. Elevation of top of ducts and pipes.
  9. Dimensions of main duct runs from building grid lines.
  10. Duct and pipe fittings.
  11. Reinforcement and spacing.
  12. Suspended ceiling components.
  13. Structural members to which duct and piping will be attached.
  14. Size and location of initial access modules for acoustical tile.
  15. Penetrations of smoke barriers and fire-rated construction.
  16. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling details and perimeter moldings.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Welding certificates.
- C. Field quality-control test reports.
- D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

#### 1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.
- B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

## 1.9 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the same manufacturer as the grooved components.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
- E. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 2. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- F. Steel Pressure-Seal Fittings:
  - 1. Housing: Steel.
  - 2. O-Rings and Pipe Stop: EPDM.
  - 3. Tools: Manufacturer's special tool.
  - 4. Minimum 300-psig (2070-kPa) working-pressure rating at 230 deg F (110 deg C).
- G. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.



## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- C. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- F. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. National Fittings, Inc.
    - c. Victaulic Company.
  - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron;; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 3. Couplings: Ductile-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
    - a. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9.
      - 1. 2" through 8": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Gasket shall be Grade "EHP" EPDM suitable for hot water up to 250 deg F.
      - 2. 10" and 12": Standard rigid coupling with Grade "E" EPDM gasket suitable for hot water up to 230 deg F.
      - 3. 14" and larger: AGS couplings designed to fit into a deeper, wedge-shaped groove. Two ductile iron housings cast with a wide key profile and flat bolt pads for metal-to-metal contact. Wide-width, gasket Grade "E" EPDM suitable for hot water up to 230.
    - b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors for vibration isolation at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the source of vibration.
      - 1. 2" through 8": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts. Gasket shall be Grade "EHP" EPDM suitable for hot water up to 250 deg F.

2. 10" and 12": Standard flexible coupling with Grade "E" EPDM gasket suitable for hot water up to 230 deg F.
  3. 14" and larger: AGS couplings designed to fit into a deeper, wedge-shaped groove. Two ductile iron housings cast with a wide key profile and flat bolt pads for metal-to-metal contact. Wide-width gasket, Grade "E" EPDM suitable for hot water up to 230 deg F.
- G. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.
- H. Viega Press Fittings:
1. Tubing standard: copper tubing shall conform to ASTM B75 within Viega specifications or ASTM B88.
  2. Alloy: Copper alloy - UNS C12200.
  3. Fitting standard: copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.
  4. Press fitting: copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. EPDM (Ethylene Propylene Diene Monomer) is a synthetically manufactured and peroxidically cured all-purpose elastomer. Sealing elements shall be factory installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:

2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
  1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Description:
    - a. Standard: IAPMO PS 66
    - b. Electroplated steel nipple, complying with ASTM F 1545.
    - c. Pressure Rating: 300 psig at 230 deg F.
    - d. End Connections: Male threaded or grooved.
    - e. Lining: Inert and noncorrosive, propylene.

## 2.5 VALVES

- A. Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
  1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  3. Ball: Brass or stainless steel.
  4. Plug: Resin.
  5. Seat: PTFE.
  6. End Connections: Threaded or socket.
  7. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
  8. Handle Style: Lever, with memory stop to retain set position.
  9. CWP Rating: Minimum 125 psig.
  10. Maximum Operating Temperature: 250 deg F.

- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
  3. Ball: Brass or stainless steel.
  4. Stem Seals: EPDM O-rings.
  5. Disc: Glass and carbon-filled PTFE.
  6. Seat: PTFE.
  7. End Connections: Flanged or grooved.
  8. Pressure Gauge Connections: Integral seals for portable differential pressure meter.
  9. Handle Style: Lever, with memory stop to retain set position.
  10. CWP Rating: Minimum 125 psig.
  11. Maximum Operating Temperature: 250 deg F.
- E. Diaphragm-Operated Safety Valves:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Body: Bronze or brass.
  3. Disc: Glass and carbon-filled PTFE.
  4. Seat: Brass.
  5. Stem Seals: EPDM O-rings.
  6. Diaphragm: EPT.
  7. Wetted, Internal Work Parts: Brass and rubber.
  8. Inlet Strainer: stainless steel, removable without system shutdown.
  9. Valve Seat and Stem: Noncorrosive.
  10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- F. Automatic Flow-Control Valves:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Body: Brass or ferrous metal.
  3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
  4. Combination Assemblies: Include bronze or brass-alloy ball valve.
  5. Identification Tag: Marked with zone identification, valve number, and flow rate.
  6. Size: Same as pipe in which installed.
  7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
  8. Minimum CWP Rating: 175 psig.
  9. Maximum Operating Temperature: 200 deg F.

## 2.6 AIR CONTROL DEVICES

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Manual Air Vents:
1. Body: Bronze.
  2. Internal Parts: Nonferrous.
  3. Operator: Screwdriver or thumbscrew.
  4. Inlet Connection: NPS 1/2.

5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Air Purgers:

1. Body: Cast iron with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal.
2. Maximum Working Pressure: 150 psig.
3. Maximum Operating Temperature: 250 deg F.

## 2.7 CHEMICAL TREATMENT

- A. Bypass Chemical Feeder: Welded steel construction; 300-psig working pressure; 7.5-gal. capacity; with fill funnel, stainless steel dissolving basket, 1-micron bag filter, and drain valves. Inlet and outlet connections shall be oversized to allow for 10% of total system waterflow.
1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

## 2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

- D. Stainless-Steel Bellow, Flexible Connectors:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
    - a. Body: Stainless-steel bellows with woven, flexible, stainless-steel, wire-reinforcing protective jacket.
    - b. End Connections: Threaded or flanged to match equipment connected.
    - c. Performance: Capable of 3/4-inch misalignment.
    - d. CWP Rating: 150 psig.
    - e. Maximum Operating Temperature: 250 deg F.
- E. Expansion fittings are specified in Section 230516 "Expansion Fittings and Loops for HVAC Piping."

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Hot Water heating-water piping, aboveground, outside of natatorium, NPS 2 and smaller, shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered and/or press joints.
- B. Hot Water heating-water heating piping, aboveground, outside of natatorium, NPS 2-1/2 and larger, shall be one of the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Blowdown-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered and/or press joints.
- D. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
  - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

### 3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install throttling-duty valves at each branch connection to return main unless otherwise indicated.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Identify piping as specified in Section 230553 "Identification for HVAC Piping and Equipment."
- U. 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."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

#### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
  - 8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.



- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel or groove plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings. Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A Victaulic factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

### 3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
- C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- D. Install coalescing-type air eliminator and dirt separator in-line air separators in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- E. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.
- F. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system project requirements.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gauges and thermometers at coil inlet and outlet connections according to Section 230519 "Meters and Gauges for HVAC Piping."

### 3.8 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics:
  - 1. pH: 9.0 to 10.5.
  - 2. "P" Alkalinity: 100 to 500 ppm.
  - 3. Boron: 100 to 200 ppm.
  - 4. Chemical Oxygen Demand: Maximum 100 ppm.
  - 5. Corrosion Inhibitor:
    - a. Sodium Nitrate: 1000 to 1500 ppm.
    - b. Molybdate: 200 to 300 ppm.
    - c. Chromate: 200 to 300 ppm.
    - d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
    - e. Chromate Plus Molybdate: 50 to 100 ppm each.
  - 6. Soluble Copper: Maximum 0.20 ppm.
  - 7. Tolyriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
  - 8. Total Suspended Solids: Maximum 10 ppm.

9. Ammonia: Maximum 20 ppm.
  10. Free Caustic Alkalinity: Maximum 20 ppm.
  11. Microbiological Limits:
    - a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.
    - b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.
    - c. Nitrate Reducers: 100 organisms/ml.
    - d. Sulfate Reducers: Maximum 0 organisms/ml.
    - e. Iron Bacteria: Maximum 0 organisms/ml.
- B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

### 3.9 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
  2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.

- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  7. Verify lubrication of motors and bearings.

END OF SECTION 232113

## SECTION 232213 - STEAM AND CONDENSATE HEATING 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 pipe and fittings for LP steam and condensate piping:
  - 1. Steel pipe and fittings.
  - 2. Fiberglass pipe and fittings.
  - 3. Joining materials.
- B. Related Requirements:
  - 1. Section 232216 "Steam and Condensate Heating Piping Specialties" for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Steel pipe and fitting.
  - 2. Fiberglass pipe and fitting.
  - 3. Joining material.
- B. Shop/Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at 1/4" = 1'-0" scale, double lined. Drawings shall indicate duct and pipe layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items and trades involved: (Submit 3 hard copies of all documents to Architect for Review and Approval):
  - 1. Duct and piping installation in all spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct and piping layout.
  - 2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 3. Fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides.
  - 4. Detail location of anchors, alignment guides, and expansion joints and loops.
  - 5. Factory- and shop-fabricated ducts and fittings.
  - 6. Duct layout indicating sizes, configuration, liner material, static-pressure class, and service.
  - 7. Piping layout indicating sizes, configuration, and service.
  - 8. Elevation of top of ducts and pipes.
  - 9. Dimensions of main duct runs from building grid lines.
  - 10. Duct and pipe fittings.
  - 11. Reinforcement and spacing.
  - 12. Suspended ceiling components.
  - 13. Structural members to which duct and piping will be attached.

14. Size and location of initial access modules for acoustical tile.
15. Penetrations of smoke barriers and fire-rated construction.
16. Items penetrating finished ceiling including the following:
  - a. Lighting fixtures.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Ceiling details and perimeter moldings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Suspended ceiling components.
  2. Other building services.
  3. Structural members.
- B. Qualification Data: For Installer.
- C. Welding certificates.
- D. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  1. Fiberglass Pipe and Fitting Installers: Installers of fiberglass pipe and fittings shall be certified by the manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to the following:
  1. ASME Compliance: Comply with ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," for materials, products, and installation.
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
  1. LP Steam Piping: 5 psig.
  2. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  3. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
  4. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

## 2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, plain ends, welded and seamless, Grade B, and Schedule as indicated in piping applications articles.
- B. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300 as indicated in piping applications articles.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in piping applications articles.
- D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- E. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- F. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, black steel of same Type, Grade, and Schedule as pipe in which installed.

## 2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. 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.
- D. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

## PART 3 - EXECUTION

### 3.1 LP STEAM PIPING APPLICATIONS

- A. LP Steam Piping, NPS 2 and Smaller: Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.
- B. LP Steam Piping, NPS 2-1/2 through NPS 12: Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- C. Condensate piping above grade, NPS 2 and smaller, shall be the following:
  - 1. Schedule 80, Type S, Grade B, steel pipe; Class 125 cast-iron fittings; and threaded joints.

- D. Condensate piping above grade, NPS 2-1/2 and larger, shall be the following:
  - 1. Schedule 80, Type E, Grade B, steel pipe; Class 150 wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
  - 2. RTRP and Glass-Fiber-Reinforced Thermosetting-Resin pipe with adhesive or flanged joints.

### 3.2 ANCILLARY PIPING APPLICATIONS

- A. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- B. Vacuum-Breaker Piping: Outlet, same as service where installed.
- C. Safety-Valve-Inlet and -Outlet Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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 otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, NPS 3/4 full port-ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install steam supply piping at a minimum uniform grade of 0.2 percent downward in direction of steam flow.



- M. Install condensate return piping at a minimum uniform grade of 0.4 percent downward in direction of condensate flow.
  - N. Reduce pipe sizes using eccentric reducer fitting installed with level side down.
  - O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to top of main pipe.
  - P. Install valves according to the following Sections or other Sections as needed:
    - 1. Section 230523 "General-Duty Valves for HVAC Piping."
  - Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
  - R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
  - S. Install shutoff valve immediately upstream of each dielectric fitting.
  - T. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
  - U. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
  - V. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
  - W. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, and control valves.
    - 1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet.
    - 2. Size drip legs same size as main. In steam mains NPS 6 and larger, drip leg size can be reduced, but to no less than NPS 4.
  - X. 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."
  - Y. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
  - Z. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."
- 3.4 STEAM AND CONDENSATE PIPING SPECIALTIES INSTALLATION
- A. Comply with requirements in Section 232216 "Steam and Condensate Heating Piping Specialties" for installation requirements for strainers, flash tanks, special-duty valves, steam traps, thermostatic air vents and vacuum breakers, and steam and condensate meters.

### 3.5 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for installation of hangers and supports. Comply with requirements below for maximum spacing.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
- C. Install hangers for steel steam supply piping with the following maximum spacing:
  - 1. NPS 3/4: Maximum span, 9 feet.
  - 2. NPS 1: Maximum span, 9 feet.
  - 3. NPS 1-1/2: Maximum span, 12 feet.
  - 4. NPS 2: Maximum span, 13 feet.
  - 5. NPS 2-1/2: Maximum span, 14 feet.
  - 6. NPS 3 and Larger: Maximum span, 15 feet.
- D. Install hangers for steel steam condensate piping with the following maximum spacing:
  - 1. NPS 3/4: Maximum span, 7 feet.
  - 2. NPS 1: Maximum span, 7 feet.
  - 3. NPS 1-1/2: Maximum span, 9 feet.
  - 4. NPS 2: Maximum span, 10 feet.
  - 5. NPS 2-1/2: Maximum span, 11 feet.
  - 6. NPS 3 and Larger: Maximum span, 12 feet.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- F. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

### 3.6 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe 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 unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

- E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- F. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install traps and control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install vacuum breakers downstream from control valve, close to coil inlet connection.
- E. Install a drip leg at coil outlet.

### 3.8 FIELD QUALITY CONTROL

- A. Prepare steam and condensate piping according to ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping," and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush system with clean water. Clean strainers.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform the following tests and inspections:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
  - 3. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
- E. Prepare test and inspection reports.

END OF SECTION 232213

## SECTION 232216 - STEAM AND CONDENSATE HEATING PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes the following piping specialties for steam and condensate piping:
  - 1. Strainers.
  - 2. Stop-check valves.
  - 3. Safety valves.
  - 4. Pressure-reducing valves.
  - 5. Steam traps.
  - 6. Thermostatic air vents and vacuum breakers.
  - 7. Flexible connectors.
- B. Related Requirements:
  - 1. Section 230523 "General-Duty Valves for HVAC Piping"
  - 2. Section 230900 "Instrumentation and Control for HVAC" for automatic control valve and sensor specifications, installation requirements, and locations.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Strainer.
  - 2. Valve.
  - 3. Steam trap.
  - 4. Air vent and vacuum breaker.
  - 5. Connector.
  - 6. Meter.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For valves, safety valves, pressure-reducing valves, steam traps, air vents, vacuum breakers, and meters to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to the following:
  - 1. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:
  - 1. LP Steam Piping: 5 psig.
  - 2. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  - 3. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
  - 4. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

### 2.2 STRAINERS

- A. Y-Pattern Strainers:
  - 1. Body: ASTM A 126, Class B cast iron, with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for strainers NPS 2 and smaller; flanged ends for strainers NPS 2-1/2 and larger.
  - 3. Strainer Screen: Stainless-steel, 60-mesh strainer or perforated stainless-steel basket.
  - 4. Tapped blowoff plug.
  - 5. CWP Rating: 250-psig working steam pressure.

### 2.3 STOP-CHECK VALVES

- A. Stop-Check Valves:
  - 1. Body and Bonnet: Malleable iron.
  - 2. End Connections: Flanged.
  - 3. Disc: Cylindrical with removable liner and machined seat.
  - 4. Stem: Brass alloy.
  - 5. Operator: Outside screw and yoke with cast-iron handwheel.
  - 6. Packing: PTFE-impregnated packing with two-piece packing gland assembly.
  - 7. Pressure Class: 250.

### 2.4 STEAM SAFETY VALVES

- A. Bronze or Brass Steam Safety Valves: ASME labeled.
  - 1. Disc Material: Forged copper alloy.
  - 2. End Connections: Threaded inlet and outlet.
  - 3. Spring: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
  - 4. Pressure Class: 250.
  - 5. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet, with threads complying with ASME B1.20.1.
  - 6. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code.

## 2.5 STEAM TRAPS

### A. Float and Thermostatic Steam Traps:

1. Body and Bolted Cap: ASTM A 126 cast iron.
2. End Connections: Threaded.
3. Float Mechanism: Replaceable, stainless steel.
4. Head and Seat: Hardened stainless steel.
5. Trap Type: Balanced pressure.
6. Thermostatic Bellows: Stainless steel or monel.
7. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.
8. Vacuum Breaker: Thermostatic with phosphor bronze bellows, and stainless-steel cage, valve, and seat.
9. Maximum Operating Pressure: 125 psig.

## 2.6 THERMOSTATIC AIR VENTS AND VACUUM BREAKERS

### A. Thermostatic Air Vents:

1. Body: Cast iron, bronze, or stainless steel.
2. End Connections: Threaded.
3. Float, Valve, and Seat: Stainless steel.
4. Thermostatic Element: Phosphor bronze bellows in a stainless-steel cage.
5. Pressure Rating: 125 psig.
6. Maximum Temperature Rating: 350 deg F.

### B. Vacuum Breakers:

1. Body: Cast iron, bronze, or stainless steel.
2. End Connections: Threaded.
3. Sealing Ball, Retainer, Spring, and Screen: Stainless steel.
4. O-Ring Seal: Ethylene propylene rubber.
5. Pressure Rating: 300 psig.
6. Maximum Temperature Rating: 350 deg F.

## 2.7 FLEXIBLE CONNECTORS

### A. Stainless-Steel Bellows, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforced, 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 branch connections to steam supply mains, at steam supply connections to equipment, and at the outlet of steam traps.

- B. Install safety valves on pressure-reducing stations and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

### 3.2 PIPING INSTALLATION

- A. Install piping to permit valve servicing.
- B. Install drains, consisting of a tee fitting, NPS 3/4 full-port ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Install valves according to Section 230523.11 "Globe Valves for HVAC Piping," Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," Section 230523.14 "Check Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
- D. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment and elsewhere as indicated.
- E. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install strainers on supply side of control valves, pressure-reducing valves, traps, and elsewhere as indicated. Install NPS 3/4 nipple and full-port ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 20.

### 3.3 STEAM-TRAP INSTALLATION

- A. Install steam traps in accessible locations as close as possible to connected equipment.
- B. Install full-port ball valve, strainer, and union upstream from trap; install union, check valve, and full-port ball valve downstream from trap unless otherwise indicated.

### 3.4 PRESSURE-REDUCING VALVE INSTALLATION

- A. Install pressure-reducing valves in accessible location for maintenance and inspection.
- B. Install bypass piping around pressure-reducing valves, with globe valve equal in size to area of pressure-reducing valve seat ring, unless otherwise indicated.
- C. Install gate valves on both sides of pressure-reducing valves.
- D. Install unions or flanges on both sides of pressure-reducing valves having threaded- or flanged-end connections, respectively.

- E. Install pressure gages on low-pressure side of pressure-reducing valves after the bypass connection according to Section 230519 "Meters and Gages for HVAC Piping."
- F. Install strainers upstream for pressure-reducing valve.
- G. Install safety valve downstream from pressure-reducing valve station.

### 3.5 SAFETY VALVE INSTALLATION

- A. Install safety valves according to ASME B31.1, "Power Piping," and ASME B31.9, "Building Services Piping."
- B. Pipe safety-valve discharge without valves to atmosphere outside the building.
- C. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.
- D. Install exhaust head with drain to waste, on vents equal to or larger than NPS 2-1/2.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Install traps and control valves in accessible locations close to connected equipment.
- B. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- C. Install vacuum breakers downstream from control valve, close to coil inlet connection.

END OF SECTION 232216



## SECTION 232300 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
  - 2. Suction Lines for Heat-Pump Applications: 535 psig.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Thermostatic expansion valves.
  - 2. Solenoid valves.
  - 3. Hot-gas bypass valves.
  - 4. Filter dryers.
  - 5. Strainers.
  - 6. Pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Shop Drawing Scale: 1/4 inch equals 1 foot
- C. Delegated-Design Submittal: Provide refrigerant size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment. Provide analysis and data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate requirements based on equipment capacities and equipment characteristics.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

## 1.8 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## 1.9 COORDINATION

- A. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at ¼" = 1'-0" scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved: (Submit 3 hard copies of all documents to Architect for Review):
  - 1. Refrigerant piping installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to refrigerant pipe layout.
  - 2. Suspended ceiling components.
  - 3. Structural members to which refrigerant pipe will be attached.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Penetrations of smoke barriers and fire-rated construction.
  - 6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: Hard Copper, ANSI H23.5 Type L ACR, and ASTM B 88 Type L ACR , in accordance with ASTM B280.
- B. Wrought-Copper Fittings: ASME B16.22.

- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8.
- E. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

## 2.2 VALVES AND SPECIALTIES

- A. Thermostatic Expansion Valves: Comply with ARI 750.
  - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  - 3. Packing and Gaskets: Non-asbestos.
  - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  - 5. Suction Temperature: 40 deg F .
  - 6. End Connections: Socket, flare, or threaded union.
  - 7. Working Pressure Rating: 700 psig.
- B. Straight-Type Strainers:
  - 1. Body: Welded steel with corrosion-resistant coating.
  - 2. Screen: 100-mesh stainless steel.
  - 3. End Connections: Socket or flare.
  - 4. Working Pressure Rating: 500 psig .
  - 5. Maximum Operating Temperature: 275 deg F.
- C. Angle-Type Strainers:
  - 1. Body: Forged brass or cast bronze.
  - 2. Drain Plug: Brass hex plug.
  - 3. Screen: 100-mesh monel.
  - 4. End Connections: Socket or flare.
  - 5. Working Pressure Rating: 500 psig.
  - 6. Maximum Operating Temperature: 275 deg F.
- D. Moisture/Liquid Indicators:
  - 1. Body: Forged brass.
  - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  - 3. Indicator: Color coded to show moisture content in ppm.
  - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  - 5. End Connections: Socket or flare.
  - 6. Working Pressure Rating: 500 psig.
  - 7. Maximum Operating Temperature: 240 deg F.

- E. Replaceable-Core Filter Dryers: Comply with ARI 730.
  - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
  - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  - 3. Desiccant Media: Activated alumina.
  - 4. End Connections: Socket.
  - 5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  - 6. Maximum Pressure Loss: 2 psig.
  - 7. Working Pressure Rating: 500 psig.
  - 8. Maximum Operating Temperature: 240 deg F.
- F. Receivers: Comply with ARI 495.
  - 1. Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  - 2. Comply with UL 207; listed and labeled by an NRTL.
  - 3. Body: Welded steel with corrosion-resistant coating.
  - 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
  - 5. End Connections: Socket or threaded.
  - 6. Working Pressure Rating: 500 psig.
  - 7. Maximum Operating Temperature: 275 deg F.

## 2.3 REFRIGERANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Atofina Chemicals, Inc.
  - 2. DuPont Company; Fluorochemicals Div.
  - 3. Honeywell, Inc.; Genetron Refrigerants.
  - 4. INEOS Fluor Americas LLC.
- B. ASHRAE 34, R-410A
- C. ASHRAE 34, R-134A

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Hard Copper, Type L ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings and Delegated-Design.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- P. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- S. 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."

- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

### 3.3 PIPE 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 pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Support multi-floor vertical runs at least at each floor.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high-, low-pressure, and hot gas reheat side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
  - a. Pressure Test: Test refrigerant piping using dry, oil-free nitrogen, and prove tight at 300psi on the high side, 300 psi on the hot gas reheat side, and 150 psi on the low side. Maintain pressure for 2 hours with no leakage or reduction in pressure.
  - b. System shall maintain test pressure at the manifold gage throughout duration of test.
  - c. Test joints and fittings with by brushing a small amount of soap and glycerin solution over joints and electronic leak detector.
  - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
  - e. Include Test and Inspection report in Operation and Maintenance submittal.

### 3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
  1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuation: Using high vacuum pump and certified micron gage, reduce absolute pressure on both sides of system simultaneously to 500 microns and 500 microns. After reaching this point charge system with refrigerant until pressure of 0psi is obtained. Repeat evacuation procedure for 2 more cycles, totaling three evacuation-charging cycles. On final evacuation, secure pump and maintain 500 microns and 500 microns for 12 hours before charging with required final refrigerant. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system with a new filter-dryer core in charging line.

### 3.7 ADJUSTING

- A. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  1. Verify that compressor oil level is correct.
  2. Open compressor suction and discharge valves.
  3. Open refrigerant valves except bypass valves that are used for other purposes.
  4. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- B. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

## SECTION 232500 - HVAC WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes water-treatment systems for the following:
  - 1. Hot water piping (closed-loop system).

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.
- B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
  - 1. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the water characteristics recommended by the boiler manufacture.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:
  - 1. Pumps.
  - 2. Control equipment and devices.
  - 3. Test equipment.
  - 4. Chemicals.
  - 5. Filters.
  - 6. Chemical feeders.
- B. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site prior and post system drainage.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Maintenance Data: For pumps, feeders, filters, system controls, and accessories to include in maintenance manuals.



## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Provide all equipment and chemicals through an experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project. The installer shall be a member in good standing of the Association of Water Technologies and the water program shall be supervised by a Certified Water Technologist. The representative shall reside within 100 miles of the job site and maintain a laboratory for water testing.

## 1.6 MAINTENANCE

- A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the heating hot-water and heat recovery piping and equipment:
  - 1. Initial water analysis and recommendations.
  - 2. Startup assistance.
  - 3. Customer report charts and log sheets.
  - 4. Laboratory technical assistance.
  - 5. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
  - 6. Operator test kits and reagents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. HVAC Water-Treatment Products:
    - a. M.I.S of America, Inc. Present campus provider

### 2.2 HOT WATER AND HEAT RECOVERY PIPING (CLOSED-LOOP SYSTEM)

- A. System cleaning
  - 1. The entire closed loop system shall be cleaned to remove cutting oils, scale deposits, oxides and other fouling as has determined by the water treatment consultant. A water meter shall be installed on the supply line as the system is being filled with water so that an accurate system volume can be determined. A non-acid solution of dispersants such as M.I.S of America, Inc. formula 6200NAC shall be added at a rate of one gallon to 500 gallons of system water. This solution shall be circulated for a minimum of 8 hours. This solution shall be tested by the water treatment consultant to insure the proper dispersant level is being maintained. After the solution has been circulated for a minimum of 8 hours the entire system shall be drained and flushed. A second analysis of the flush water shall be made to insure all of the cleaner is removed and that the system is clean.

B. Service

The water treatment consultant shall perform monthly on site tests of the system for the first year. These tests shall include, but not be limited to, the following:

PH  
Hardness  
T- Alkalinity  
Inhibitor Level  
% Glycol  
Freeze point  
Oxides matching the metallurgy of the system.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Provide an initial water supply analysis to determine the specific program and the quantities of chemical to be supplied to match existing conditions. A copy of the analysis shall be submitted to the engineer.

3.2 EXISTING SYSTEM DRAINAGE

- A. Drain existing hot water heating system in order to accommodate work.  
B. Salvage existing propylene glycol solution in OSHA approved barrels.  
C. Store barrels during construction in dry secure area.

3.3 INSTALLATION

- A. Installation by the contractor with supervision of the supplier.  
1. Installing the contractor to coordinate with the chemical equipment and product supplier.  
2. Install equipment plumb and level.  
3. Add cleaning chemicals as recommended by the supplier.  
B. Test system mixture and provide report to engineer for approval

END OF SECTION 232500

## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Duct Liners.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
- B. Related Sections:
  - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Adhesives.
  - 2. Sealants and gaskets.
- B. Shop Drawings:
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Factory- and shop-fabricated ducts and fittings.
  - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
  - 4. Elevation of top of ducts.
  - 5. Dimensions of main duct runs from building grid lines.
  - 6. Fittings.
  - 7. Reinforcement and spacing.
  - 8. Seam and joint construction.
  - 9. Penetrations through fire-rated and other partitions.
  - 10. Equipment installation based on equipment being used on Project.

11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
  12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.
- C. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at 1/4" = 1'-0" scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved: (Submit 3 hard copies of all documents to Architect for Review):
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  2. Suspended ceiling components.
  3. Structural members to which duct will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Penetrations of smoke barriers and fire-rated construction.
  6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.
- D. Welding certificates.
- E. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- D. 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.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.4 DUCT LINER

- A. Flexible Elastomeric Noise Reducing Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armacell LLC, Coilflex.
    - b. Aeroflex USA Inc
    - c. Rubatex International, LLC
  - 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
  - 3. Minimum thermal conductivity: .25 BTU-in/h-ft<sup>2</sup>-F
  - 4. Rated for 180 degree F max and -297 degree F min
  - 5. Noncorrosive
  - 6. Antimicrobial
  - 7. Sound transmission rating: 25
  - 8. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

- a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
  - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  - 3. Butt transverse joints without gaps, and coat joint with adhesive.
  - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  - 7. Adhere to duct with adhesive and secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  - 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  - 2. Tape Width: 3 inches.
  - 3. Sealant: Modified styrene acrylic.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 7. Service: Indoor and outdoor.
  - 8. Service Temperature: Minus 40 to plus 200 deg F.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.
  4. Solids Content: Minimum 60 percent.
  5. Shore A Hardness: Minimum 60.
  6. Water resistant.
  7. Mold and mildew resistant.
  8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  9. VOC: Maximum 395 g/L.
  10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  11. Service: Indoor or outdoor.
  12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.



## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.4 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.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "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.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
  - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  - 2. Test the following systems:
    - a. Supply, Return, Exhaust, and Outdoor Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
  - 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  - 4. Test for leaks before applying external insulation.
  - 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  - 6. Give fourteen days' advance notice for testing.
- C. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
  - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.8 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
  - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

- D. Clean the following components by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
  2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
  7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
  5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
  6. Provide drainage and cleanup for wash-down procedures.
  7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

### 3.9 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply, Return, Exhaust, and Outside Air:
1. Pressure Class: Positive 2-inch wg.
  2. Minimum SMACNA Seal Class: B.
  3. SMACNA Leakage Class for Rectangular: 24.
  4. SMACNA Leakage Class for Round: 24

- C. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
  - 2. Stainless-Steel Ducts:
    - a. Exposed to Airstream: Match duct material.
    - b. Not Exposed to Airstream: Galvanized.
  - 3. Aluminum Ducts: Aluminum.
- D. Liner:
  - 1. Supply Air Ducts specifically identified with an "L" after the duct size on drawings:
    - a. Flexible elastomeric noise reducing duct liner: 1 inches thick
- E. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. 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. 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 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped.
    - c. Round Elbows, 14 Inches and Larger in Diameter: Welded.
- A. 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 lateral or 90-degree with 45-degree entry.
  - 2. Round: 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 2000 fpm or Less: 45-degree lateral or 90-degree with 45-degree entry.

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. Backdraft and pressure relief dampers.
  - 2. Manual volume dampers.
  - 3. Control dampers.
  - 4. Fire dampers.
  - 5. Flange connectors.
  - 6. Turning vanes.
  - 7. Duct-mounted access doors.
  - 8. Flexible connectors.
  - 9. Flexible ducts.
  - 10. Duct accessory hardware.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
  - 2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control damper installations.
    - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
    - e. Wiring Diagrams: For power, signal, and control wiring.

- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and a No.3 finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.



## 2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.052-inch thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
  - 1. Material: Galvanized steel.
  - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.
  - 5. Screen Mounting: Front mounted in sleeve.
    - a. Sleeve Thickness: 20-gage minimum.
    - b. Sleeve Length: 6 inches minimum.
  - 6. Screen Mounting: Rear mounted.
  - 7. Screen Material: Galvanized steel.
  - 8. Screen Type: Bird.
  - 9. 90-degree stops.

## 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  - 2. Standard leakage rating.
  - 3. Suitable for horizontal or vertical applications.

4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch thick.
  6. Blade Axles: Galvanized steel.
  7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg. or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Standard leakage rating.
  3. Suitable for horizontal or vertical applications.
  4. Frames: Hat-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
  6. Blade Axles: Stainless steel.
  7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Tie Bars and Brackets: Aluminum.
- C. Low-Leakage, Steel, Manual Volume Dampers:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Low-leakage rating, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
  3. Suitable for horizontal or vertical applications.
  4. Frames:
    - a. U shaped.
    - b. Galvanized-steel channels, 0.064 inch thick.
    - c. Mitered and welded corners.
    - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized, roll-formed steel, 0.064 inch thick.

6. Blade Axles: Stainless steel.
  7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Blade Seals: Neoprene.
  9. Jamb Seals: Cambered stainless steel.
  10. Tie Bars and Brackets: Galvanized steel.
  11. Accessories:
    - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- D. Low-Leakage, Aluminum, Manual Volume Dampers:
1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
  2. Low-leakage rating, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
  3. Suitable for horizontal or vertical applications.
  4. Frames: U-shaped, 0.10-inch thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Roll-Formed Aluminum Blades: 0.10-inch thick aluminum sheet.
  6. Blade Axles: Galvanized steel.
  7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  8. Blade Seals: Neoprene.
  9. Jamb Seals: Cambered aluminum.
  10. Tie Bars and Brackets: Aluminum.
  11. Accessories:
    - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- E. Jackshaft:
1. Size: 1-inch diameter.
  2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
  2. Include center hole to suit damper operating-rod size.
  3. Include elevated platform for insulated duct mounting.

## 2.4 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Greenheck Fan Corporation.
  - 2. Nailor Industries Inc.
  - 3. Ruskin Company.
- B. Control dampers: low leakage,
  - 1. .125 inch aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin aps.
  - 2. Aluminum airfoil blades internally insulated polyurethane foam and thermally broken blade and jamb seals to be silicone rubber and external blade-to-blade linkage.
  - 3. Bearings to be dual bearing with acetal inner sleeve, flanged outer bearing resulting in no metal-to-metal or metal-to-plastic contact.
  - 4. Damper to be suitable for pressures to 8 in. Wg, velocities to 4000 fpm, air leakage rate less than 8 cfm/s.f. @ 4 in. Wg, and temperatures to 200 degrees f.
  - 5. Axle to be 0.500 in diameter plated steel
  - 6. Dimension of damper to match louver
  - 7. Control damper actuators: internal mount, 24 volt, fail open, power closed. Provide with nema type 2 enclosure, indoor dripproof

## 2.5 FIRE DAMPERS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## 2.6 FLANGE CONNECTORS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.7 TURNING VANES

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 36 inches wide and double wall for larger dimensions.

## 2.8 DUCT-MOUNTED ACCESS DOORS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Number of Hinges and Locks:
    - a. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    - b. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - c. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

- C. Pressure Relief Access Door:
1. Door and Frame Material: Galvanized sheet steel.
  2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
  3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
  4. Factory set at 10-inch wg.
  5. Doors close when pressures are within set-point range.
  6. Hinge: Continuous piano.
  7. Latches: Cam.
  8. Seal: Neoprene or foam rubber.
  9. Insulation Fill: 1-inch thick, fibrous-glass or polystyrene-foam board.

## 2.9 DUCT ACCESS PANEL ASSEMBLIES

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

## 2.10 FLEXIBLE CONNECTORS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.

- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.11 FLEXIBLE DUCTS

- A. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 175 deg F.
  4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.
- C. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

## 2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- 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. Provide volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Dampers shall be provided as necessary to achieve a NEBB certified air balance.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Install duct security bars. Construct duct security bars from 3/16-inch steel sleeve, continuously welded at all joints and 1/2-inch diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 1-by-1-by-3/16-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. At outdoor-air intakes and mixed-air plenums.
  - 3. At drain pans and seals.
  - 4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 6. At each change in direction and at maximum 50-foot spacing.
  - 7. Upstream and downstream from turning vanes.
  - 8. Upstream or downstream from duct silencers.
  - 9. Control devices requiring inspection.
  - 10. Elsewhere as indicated.
- J. Install access doors with swing against duct static pressure.



- K. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body plus Ladder Access: 25 by 17 inches.
- L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- M. Install flexible connectors to connect ducts to equipment.
- N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- O. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- P. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped in place with stainless steel band clamps.
- Q. Connect flexible ducts to metal ducts with stainless steel band clamps, adhesive, and sheet metal screws.
- R. Install duct test holes where required for testing and balancing purposes.
- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

## SECTION 233423 - HVAC POWER VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Centrifugal roof ventilators.
  - 2. Ceiling-Mounted ventilators
  - 3. In-line centrifugal fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at  $\frac{1}{4}" = 1'-0"$  scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved: (Submit 3 hard copies of all documents to Architect for Review):
  - 1. Equipment installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to layout.
  - 2. Roof framing and support members relative to duct penetrations.
  - 3. Suspended ceiling components.
  - 4. Structural members to which duct will be attached.
  - 5. Size and location of initial access modules for acoustical tile.
  - 6. Penetrations of smoke barriers and fire-rated construction.
  - 7. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set(s) for each belt-driven unit.

## 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## 1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
  - 1. Carnes Company.
  - 2. Greenheck Fan Corporation.
  - 3. Loren Cook Company.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle square, one-piece, aluminum base with venturi inlet cone.
  - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
  - 2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Accessories:
  - 1. Disconnect Switch: NEMA-3R, Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
  - 2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.
  - 1. Configuration: Built-in cant and mounting flange.
  - 2. Overall Height: Coordinate to meet with NFPA 96.
  - 3. Pitch Mounting: Manufacture curb for roof slope.
  - 4. Metal Liner: Galvanized steel.
  - 5. Mounting Pedestal: Galvanized steel with removable access panel.
  - 6. Vented Curb: Unlined with louvered vents in vertical sides.
- F. Capacities and Characteristics:
  - 1. Refer to schedule on drawings.

## 2.2 IN-LINE CENTRIFUGAL FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Diversitech (Basis of Design.)
  - 2. Carnes Company.
  - 3. Greenheck Fan Corporation.
  - 4. Loren Cook Company.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Fan Wheels: Backward inclined aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
  - 1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
  - 2. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
  - 3. Disconnect Switch: NEMA-1, Nonfusible type, with thermal-overload protection.
- F. Capacities and Characteristics:
  - 1. Refer to schedules on drawings for capacities and characteristics.

## 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.

8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  10. Shut unit down and reconnect automatic temperature-control operators.
  11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Square ceiling diffusers.
  - 2. Perforated diffusers.
  - 3. Linear slot diffusers.
  - 4. Security grilles.
  - 5. Fixed face registers and grilles.
- B. Related Sections:
  - 1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
  - 2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- C. Source quality-control reports.



## PART 2 - PRODUCTS

### 2.1 CEILING DIFFUSERS

#### A. Square Ceiling Diffusers:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel for all applications other than restrooms. Aluminum in restrooms.
4. Finish: Baked enamel, color selected by Architect.
5. Face Size: Indicated on drawing per location.
6. Face Style: Plaque.
7. Mounting: Coordinate with architectural ceiling types for each diffuser shown and provide mounting frame specific for each ceiling type.
8. Pattern: Adjustable.
9. Dampers: Radial opposed blade.
10. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Sectorizing baffles.
  - f. Operating rod extension.

#### B. Perforated Diffuser:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Extruded aluminum border and mounting frame, with aluminum face.
4. Finish: Baked enamel, color selected by Architect, with pattern controllers and back pan finished black.
5. Face Size: Indicated on drawing per location.
6. Duct Outlet: Square.
7. Face Style: Flush.
8. Mounting: Coordinate with architectural ceiling types for each diffuser shown and provide mounting frame specific for each ceiling type.
9. Pattern Controller: Adjustable with louvered pattern modules at inlet.
10. Dampers: Opposed blade.
11. Accessories:
  - a. Equalizing grid.
  - b. Safety chain.
  - c. Wire guard.
  - d. Sectorizing baffles
  - e. Operating rod extension.

#### C. Hospital Perforated Laminar Flow Diffusers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lami-air.
  - b. Price Industries.
  - c. Metalaire.

2. Devices shall be specifically designed for non-aspirating, laminar flow type in accordance with ASHRAE Standard 170. Diffusers shall utilize a two chamber plenum design to deliver air to the space with zero aspiration at the face of the perforated plate.
3. Material: Perforated, 0.050" aluminum.
4. Faceplate: Perforations to be 16% open area for 40 or less CFM per square ft. of module, 23% open area for 45-65 CFM per square ft. of module, or 33% open area for higher velocities. Plate shall be retained to the diffuser frame through use of captive, quarter-turn fasteners.
5. Diffuser basket: A solid, .040" aluminum plate with two rectangular cutouts located directly above a V-shaped diffusion basket shall separate the top and bottom chambers. The lower chamber shall have a V-shaped, perforated diffusion basket mounted within a rectangular, perforated diffusion basket to evenly distribute air over the entire face of the diffuser.
6. Diffuser plenum: The diffuser plenum shall be constructed of an .063" aluminum extrusion with mitered, back-welded corners and .040" aluminum top plate.
7. Finish: Baked enamel, color selected by Architect, with pattern controllers and back pan finished black.
8. Face Size: Indicated on drawing per location.
9. Duct Outlet: Round top or oval side inlet collar.
10. Face Style: Flush.
11. Mounting: Coordinate with architectural ceiling types for each diffuser shown and provide mounting frame specific for each ceiling type.
12. Pattern Controller: Adjustable with louvered pattern modules at inlet.
13. Dampers: Inverse conical balancing mechanism. Balancing mechanism shall be adjustable by turning a screw from the room side of the diffuser.
14. Blank-off Panne: Furnish solid face blank-off panels where indicated on the drawings and where columns may penetrate the ceiling or where interstitial access is required. Panel to have solid plate installed within extruded aluminum perimeter frame with mitered corners providing a seal between the room and interstitial space. The installing contractor shall cut all fill-in panel(s) for the surgical light column(s), medical gas column(s), and other ceiling mounted apparatus as required on the drawings after this equipment located.
15. Accessories:
  - a. Equalizing grid.
  - b. Safety chain.
  - c. Wire guard.
  - d. Sectorizing baffles
  - e. Operating rod extension.
16. Heavy-Duty Welded Ceiling Grid:
  - a. Furnish extruded aluminum tee and angle frame assembly suspension system.
  - b. Furnish 1/8" thick closed cell polyethylene gasket tape to be field installed on the frame assembly to provide an airtight seal between diffuser/tee grid or blank-off panel/tee grid interface. Gasket tape shall be free from any construction dust.

## 2.2 CEILING LINEAR SLOT OUTLETS

### A. Linear Slot Diffuser:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Aluminum, non-insulated.

4. Material - Pattern Controller and Tees: Aluminum.
5. Finish - Face and Shell: Baked enamel, white.
6. Finish - Pattern Controller: Baked enamel, black.
7. Finish - Tees: Baked enamel, color selected by Architect.
8. Slot Width: As indicated on drawings.
9. Number of Slots: Indicated on drawings per location.
10. Length: 48 inches.
11. Accessories: Factory fabricated and insulated plenum box sized for the length of the diffuser.
12. Coordinate with architectural ceiling types for each linear slot outlet shown and provide mounting frame specific for each ceiling type.

## 2.3 REGISTERS AND GRILLES

### A. Security Grille:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Security Level: Maximum.
3. Application: Ducted supply and ducted return.
4. Material: Steel.
5. Material Thickness: 3/16 in.
6. Finish: Baked enamel, color selected by Architect.
7. Face Arrangement:
  - a. Shape: Indicated on drawings for each location.
  - b. Design: Perforated.
  - c. Frame: Yes.
  - d. Deflection: Zero degrees.
  - e. Core: None.
  - f. 3/16-inch- thick perforated faceplate with 5/16-inch- diameter holes spaced 7/16 inch o.c., staggered at 60 degrees.
8. Wall Sleeve: 3/16 inch welded to face.
9. Mounting: 1-1/4-by-1-1/4-by-3/16-inch retaining angle frame.

### B. Fixed Face Register:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Louvered with 3/4 in. spacing.
5. Core Construction: Integral double deflection.
6. Frame: 1-1/4 inches wide.
7. Mounting Frame: Welded with precision mitered corners.
8. Mounting: Countersunk screw.
9. Damper Type: Adjustable opposed blade.

### C. Fixed Face Grille:

1. Performance: Subject to compliance with requirements and related documents, provide products meeting a minimum performance of the following:
2. Material: Steel.
3. Finish: Baked enamel, color selected by Architect.

4. Face Arrangement: Louvered with 3/4" spacing.
5. Core Construction: Integral opposed blade damper.
6. Frame: 1-1/4 inches wide.
7. Mounting Frame: Welded with precision mitered corners.
8. Mounting: Countersunk screw.

## 2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

## SECTION 233723 - HVAC GRAVITY VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Roof hoods.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
  - 2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.
- C. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. For louvered-penthouse ventilators specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at ¼" = 1'-0" scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved:

- B. Roof framing plans and other details on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members to which roof curbs and ventilators will be attached.
  - 2. Sizes and locations of roof openings.

- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

## 1.7 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.
- E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.
  - 2. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.2 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

## 2.3 ROOF HOODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Greenheck Fan Corporation.
  - 2. Loren Cook Company
  - 3. Carnes.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 6-6 and 6-7.
- C. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood; suitably reinforced.
- D. Bird Screening: Stainless-steel, 1/2-inch- square mesh, 0.047-inch wire.
- E. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
  - 1. Configuration: Built-in raised cant and mounting flange.
  - 2. Overall Height: 18 inches.

## 2.4 DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Greenheck Fan Corporation.
  - 2. Nailor Industries Inc.
  - 3. Ruskin Company.
- B. Control dampers: low leakage, insulated
  - 1. .125 inch aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin aps.
  - 2. Aluminum airfoil blades internally insulated polyurethane foam and thermally broken blade and jamb seals to be silicone rubber and external blade-to-blade linkage.
  - 3. Bearings to be dual bearing with acetal inner sleeve, flanged outer bearing resulting in no metal-to-metal or metal-to-plastic contact.
  - 4. Damper to be suitable for pressures to 8 in. Wg, velocities to 4000 fpm, air leakage rate less than 8 cfm/s.f. @ 4 in. Wg, and temperatures to 200 degrees f.
  - 5. Axle to be 0.500 in diameter plated steel
  - 6. Dimension of damper to match louver
  - 7. Control damper actuators: internal mount, 120 volt, fail open, power closed. Provide with nema type 2 enclosure, indoor dripproof.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install gravity ventilators with clearances for service and maintenance.
- C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Install duct security bars at building penetration. Construct duct security bars from 3/16-inch steel sleeve, continuously welded at all joints and 1/2-inch diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 1-by-1-by-3/16-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.
- F. Label gravity ventilators according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

### 3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

END OF SECTION 233723



## SECTION 235700 - HEAT EXCHANGERS FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Shell-and-tube heat exchangers.

#### 1.2 DEFINITIONS

- A. TEMA: Tubular Exchanger Manufacturers Association.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
  - 2. Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room plan or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Product Certificates: For each type of shell-and-tube heat exchanger. Documentation that shell-and-tube heat exchangers comply with "TEMA Standards."
- C. Source quality-control reports.
- D. Sample Warranty: For manufacturer's warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

## 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including heat exchanger, storage tank, and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Shell-and-Tube Heat Exchangers:
      - 1) Tube Coil: One year(s).
      - 2) Other Components: One year(s).

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

### 2.2 SHELL-AND-TUBE HEAT EXCHANGERS

- A. Description: Packaged assembly of tank, heat-exchanger coils, and specialties.
- B. Construction:
  - 1. Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
  - 2. Fabricate and label shell-and-tube heat exchangers to comply with "TEMA Standards."
- C. Configuration: U-tube with removable bundle.
- D. Shell Materials: Steel.
- E. Head:
  - 1. Materials: Fabricated steel with removable cover.
  - 2. Flanged and bolted to shell.
- F. Tube: Cupronickel tubes.
  - 1. Tube diameter is determined by manufacturer based on service.
- G. Tubesheet Materials: Steel.
- H. Baffles: Steel.
- I. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tapings to shell before testing and labeling.
  - 1. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
  - 2. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- J. Support Saddles:
  - 1. Fabricated of material similar to shell.
  - 2. Fabricate foot mount with provision for anchoring to support.

## 2.3 ACCESSORIES

- A. Hangers and Supports:
  - 1. Custom-built steel supports and saddles for mounting on floor.
    - a. Minimum Number of Saddles: 2.
  - 2. Supports and saddles to ensure both horizontal and vertical support of heat exchanger. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Miscellaneous Components for High-Temperature, Hot-Water Unit: Control valve, valves, thermometers, and piping. Include components fitted for electric control.
- C. Miscellaneous Components for Steam Unit: Strainers, steam-control valve, steam trap, valves, pressure gauge, thermometers, and piping. Include components fitted for electric control.
- D. Pressure-Relief Valves: Bronze, ASME rated and stamped.

## 2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect heat exchangers in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME International label.
- B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.
- C. Heat exchangers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.
- B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF HEAT EXCHANGER, GENERAL

- A. Equipment Mounting:
  - 1. Install floor-mounted heat exchangers on cast-in-place concrete equipment bases. Install all heat exchangers level and plumb in accordance with manufacturer's recommendations. Install floor-mounted and wall-hung steam heat exchangers at sufficient height, using sufficient length supports, to achieve required steam and condensate pipe pitch. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

### 3.3 INSTALLATION OF SHELL-AND-TUBE HEAT EXCHANGER

- A. Install heat exchangers on saddle supports.
- B. Heat-Exchanger Supports: Mount heat exchanger on steel saddles and supports specifically designed for each heat exchanger.

Retain paragraph below for projects in seismic areas.

- C. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger saddles are anchored to building structure.

### 3.4 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Heating Piping Specialties."
- C. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.
- D. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.
- E. Install shutoff valves at heat-exchanger inlet and outlet connections.
- F. Install pressure-relief valves on heat-exchanger shells where a connection has been provided on shell. When no shell pressure-relief valve connection has been provided, install pressure-relief valve on shell outlet piping before any isolation valves.
- G. Install pressure-relief valves on heat-exchanger tube outlet piping before any isolation valves.
- H. Pipe pressure-relief valves, full size of valve connection, to floor drain.
- I. Install vacuum breaker at heat-exchanger steam inlet connection.
- J. Install hose end valve to drain shell.
- K. Install thermometer on each heat-exchanger fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 230500 "Common Work Results for HVAC."
- L. Install pressure gauges on each heat-exchanger fluid inlet and outlet piping and steam inlet piping. Comply with requirements for pressure gauges specified in Section 230500 "Common Work Results for HVAC."

### 3.5 CLEANING

- A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.
- B. Isolate heat exchangers from piping before flushing piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blind flanges in flanged joints to isolate equipment.
- C. Flush heat-exchanger piping systems with clean water; then remove and clean or replace strainer screens before reopening flow to heat exchangers.

### 3.6 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. Perform tests and inspections with the assistance of a factory-authorized service representative:
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Heat exchanger will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 235700

## SECTION 236313 - CONDENSING UNITS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes air-cooled condensing units.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring diagrams.
- C. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
  - 1. Units shall be designed to operate with HCFC-free refrigerants.

#### 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period (Compressor Only): Five years from date of Substantial Completion.
  - 2. Warranty Period (Condenser Coil Only): Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 CONDENSING UNITS, AIR COOLED, 1 TO 5 TONS

- A. Manufacturers:
  - 1. Aeon.
  - 2. Trane Co. (The); Worldwide Applied Systems Group.
  - 3. York International Corp.
- B. Description: Factory assembled and tested, consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
- C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
  - 1. Motor: Includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
  - 2. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch. (2-Ton Unit)
  - 3. Variable Capacity Compressor: Include manual reset, high-pressure switch and automatic reset low pressure switch. Modulation from 10-100%. (3-Ton and higher)
  - 4. Provide factory installed suction pressure transducer.
  - 5. Accumulator: Suction tube.
  - 6. Refrigerant Charge: R-410a.
  - 7. Provide dual circuit 10 Tons and Higher.
  - 8. Provide crankcase heater.
- D. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
- E. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection.
- F. Accessories:
  - 1. Crankcase heater.
  - 2. Filter-dryer.
  - 3. High-Pressure Switch: Manual-reset switch cycles compressor off on high refrigerant pressure.
  - 4. Low Ambient Controller: Cycles condenser fan to permit operation down to 35 deg.
  - 5. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
  - 6. 24 volt control transformer factory installed.
  - 7. Provide modulating head pressure control on 10 Tons and higher
  - 8. Provide operation down to 35 Degrees F ambient.
- G. Unit Casing: Galvanized steel, finished with baked enamel capable of withstanding at least 2,500 hours salt spray test in accordance with ASTM B 117-95 test procedure; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.
- H. Verification of Performance: Rate condensing units according to ARI 210/240.

## 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate condensing units according to ARI 210/240.
  - 1. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
  - 2. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

- B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install unit level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
- B. Install condensing units on concrete base. Concrete base is specified in Division 23 Section "Basic Mechanical Materials and Methods".
- C. Install roof-mounting units on equipment supports specified in Division 23.
- D. Vibration Isolation: Mount condensing units on rubber in shear isolators.
- E. Maintain manufacturer's recommended clearances for service and maintenance.
- F. Connect pre-charged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
- G. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform electrical test and visual and mechanical inspection.
  - 2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 5. Verify proper airflow over coils.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- C. Remove and replace malfunctioning condensing units and retest as specified above.

END OF SECTION 236313



## SECTION 237413 – ROOFTOP AIR CONDITIONING UNITS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 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.

#### 1.3 SUMMARY

- A. This Section includes rooftop heating and cooling units.
- B. Related Sections include the following:
  - 1. Division 23 Section "Facilities Management System" for temperature-control devices, and control wiring and control devices connected to energy recovery units.
  - 2. Division 23 Section "Wind and or Seismic Load Rated Roof Curbs and Restraint Brackets for curb requirements.

#### 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping, installed, and operating weights; furnished specialties; accessories; and installation and startup instructions.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
  - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
- C. Commissioning Reports: Indicate results of startup and testing commissioning requirements. Submit copies of checklists.
- D. Maintenance Data: Maintenance manuals specified in Division 01.
- E. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- B. Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- C. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
  - 1. The rooftop unit(s) shall be certified in accordance with UL Standard 1995 and ANSI Standard Z21.47
  - 2. The rooftop unit(s) shall be safety certified by an accredited testing laboratory and the nameplate shall carry the label of the certification agency.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver rooftop units as factory-assembled units with protective crating and covering as recommended by the manufacturer.
- B. Coordinate delivery of units in sufficient time to allow movement into building.
- C. Handle rooftop units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

## 1.7 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations with roof construction.

## 1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
  - 1. Warranty Period, Compressors: Manufacturers standard, but not less than 5 years after date of startup.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Filters: Three (3) sets of filters for each unit.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to strict compliance with the requirements of this specification, provide products by one of the following:
  - 1. Rooftop Units:

- a. AAON, Inc. - RQ or RN Series. (Basis of Design)
- b. Valent
- c. Venmar
- d. Daikin Applied

## 2.2 ROOFTOP UNITS

- A. Description: Factory assembled and tested; designed for roof or slab installation; and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, gas heater, filters, and dampers.
- B. Construction:
  - 1. Unit shall be completely factory assembled, piped and wired and shipped in one section.
  - 2. Unit shall be specifically designed for outdoor roof top application with a fully weatherproof cabinet.
  - 3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel
  - 4. Paint finish shall be capable of withstanding at least 2500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
  - 5. The unit roof shall be sloped or cross-broken to assure drainage.
  - 6. Unit specific color coded wiring diagrams shall match the unit color coded wiring and will be provided in both point-to-point and ladder form.
  - 7. Diagrams shall also be laminated in plastic and permanently affixed inside the control compartment.
  - 8. Access to filters, blower, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn latches. Door fastening screws are not acceptable.
  - 9. Access doors shall have stainless steel hinges and full perimeter gasketing.
  - 10. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.
  - 11. Air side service access doors shall have rain break overhangs.
  - 12. Air side service access doors shall be fully gasketed with rain break overhangs and will have an internal metal liner to protect the door insulation
  - 13. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.
  - 14. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage
  - 15. Unit shall have decals and tags to indicate unit lifting and rigging, service areas and caution areas. Installation and maintenance manuals shall be supplied with each unit.
  - 16. Units exterior shall be "Off White" in color.
  - 17. Units shall have double wall insulation liners
  - 18. Units shall have base pan insulation on all units.
- C. Supply Fans:

1. Blower(s) shall be entirely self contained on a slide deck for service and removal from the cabinet.
  2. Supply blower(s) shall be direct drive, unhooded, backward curved, plenum fans.
  3. Blowers, drives and motors shall be dynamically balanced.
  4. Motor shall be inverter rated efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
  5. Variable Frequency drive shall be wired and mounted in the unit.
  6. Motors shall be provided with shaft grounding rings.
- D. Exhaust Fans
1. Exhaust Dampers shall be sized for 100% relief.
  2. Fans and motors shall be dynamically balanced.
  3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
  4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
  5. Unit shall include belt driven, unhooded, backward curved, plenum exhaust fans.
  6. Variable frequency drives shall be factory wired and mounted in the unit.
  7. Motors shall be provided with shaft grounding rings.
- E. Outside Air
1. Shall be a fully modulating, enthalpy controlled economizer with multistage integrated economizer and compressor operation for maximum benefit. The economizer shall consist of a motor operated outdoor air damper and return air damper assembly constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 15 CFM of leakage per sq. ft. of damper area when subjected to 2 in. w.g. air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.
- F. Energy Recovery
1. Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.
  2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
  3. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
  4. Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE MERV rating of 8, upstream of the wheels.
  5. Hinged service access doors shall allow access to the wheel.
  6. Aluminum Energy Recovery Wheels
    - a. Unit shall contain factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a durable segmented link drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.

- b. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coating segments shall be cleanable with hot water or air without degrading the latent recovery.
- G. Air Cooled Condenser Section:
  - 1. The condensing section shall be equipped with vertical discharge axial flow direct drive fans. Direct drive fans shall be directly connected to and supported by the motor shaft.
  - 2. The condenser coils shall be sloped at least 30 degrees to protect the coils from damage.
  - 3. Condenser shall be provided with condenser coil guards to protect against hail and freezing rain damage.
- H. Filters: 2-inch- thick, pleated panel with an ASHRAE efficiency of MERV 8. Three (3) sets of filters for each unit.
- I. Evaporator Coils:
  - 1. Evaporator coils shall be copper tube with aluminum fins mechanically bonded to the tubes.
  - 2. Evaporator coils shall have galvanized steel end casings.
  - 3. Evaporator coils shall have equalizing type vertical tube headers.
  - 4. Evaporator coils shall be furnished with a thermostatic expansion valve.
  - 5. Evaporator coils shall be furnished with a double sloped stainless steel drain pan for the positive drainage of condensate.
- J. Refrigeration System:
  - 1. Compressor(s) shall be of the hermetic scroll type with internal thermal overload protection, internal rubber vibration isolators and mounted on the compressor manufacturer recommended rubber vibration isolators.
  - 2. Compressor(s) shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the compressor compartment is open.
  - 3. Compressor(s) shall be isolated from the base pan and supply air to avoid any transmission of noise from the compressor into the building area.
  - 4. System shall be equipped with thermostatic expansion valve(s) type refrigerant flow control.
  - 5. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.
  - 6. Unit shall be equipped with service fittings on both the high side and low pressure sides of the system.
  - 7. Unit shall be equipped with refrigerant liquid line drier, and fully charged with Refrigerant R-410a
  - 8. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit(s) which shall be capable of modulation from 10-100% of its capacity
  - 9. All circuits shall be equipped with liquid line sight glasses.
  - 10. Unit shall be equipped with a 5-minute anti-short cycle delay timer for each compressor.
  - 11. Unit shall be equipped with a 20 second time delay between each stage of compressor operation.
  - 12. All circuits shall be equipped with compressor isolation valves.
  - 13. Modulating head pressure control shall be provided.
  - 14. Low ambient control to 35°F shall be provided.
  - 15. Provide adjustable compressor lockout.
- K. Hot Water Heating Coils

1. Unit Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
  2. Coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
  3. Coils shall be located in the reheat position downstream of the supply fans.
  4. Control valves shall be field supplied and field installed.
- L. Power
1. Unit shall be provided with a factory installed and wired internal disconnect.
  2. Unit shall be provided with a factory installed and wired 115 volt, 15 amp ground fault service receptacle powered by a 1.5 KVA transformer.
- M. Temperature Controls
1. Controls: Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. A step down transformer shall be provided for all 24 volt control functions. The resident control logic shall make all heating, cooling and/or ventilating decisions in response to electronic signals from the BAS controller. Control logic shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.
  2. Control System Interface: The BAS controller and control components shall be supplied by others and installed in the field.
- N. ROOF CURB ADAPTORS (See curb details for additional information)
1. Roof curbs shall be constructed of galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curbs shall be wind resistant.
    - a. Unit shall be mounted on a factory furnished field assembled style roof curb, fully lined with 1" of neoprene coated, fiberglass insulation and with a wood nailer strip.
    - b. Units shall be provided with two (2) layers of Sound Seal B10 Lag/QFA-1 insulation in all units.
    - c. Refer to specification section 230548 'Wind and or Seismic Load Rated Roof Curbs and Restraint Brackets' for additional requirements.
    - d. Contractor shall provide blocking between deck and curb.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where AHUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Unit Support: Secure RTUs to structural support with anchor bolts.

### 3.3 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install piping adjacent to AHUs to allow service and maintenance.
- C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 23 33 00 "Air Duct Accessories."
  - 4. Install return-air duct continuously through roof structure.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
  - 1. After installing AHUs and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
  - 1. Inspect for visible damage to unit casing.
  - 2. Inspect for visible damage to furnace combustion chamber.
  - 3. Inspect for visible damage to compressor, coils, and fans.
  - 4. Inspect internal insulation.
  - 5. Verify that labels are clearly visible.
  - 6. Verify that clearances have been provided for servicing.
  - 7. Verify that controls are connected and operable.
  - 8. Verify that filters are installed.
  - 9. Clean condenser coil and inspect for construction debris.
  - 10. Clean furnace flue and inspect for construction debris.
  - 11. Connect and purge gas line.
  - 12. Remove packing from vibration isolators.
  - 13. Inspect operation of barometric relief dampers.

14. Verify lubrication on fan and motor bearings.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
  - a. Start refrigeration system.
  - b. Do not operate below recommended low-ambient temperature.
  - c. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency.
  - a. Measure gas pressure on manifold.
  - b. Inspect operation of power vents.
  - c. Measure combustion-air temperature at inlet to combustion chamber.
  - d. Measure flue-gas temperature at furnace discharge.
  - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
  - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
  - a. Coil leaving-air, dry- and wet-bulb temperatures.
  - b. Coil entering-air, dry- and wet-bulb temperatures.
  - c. Outdoor-air, dry-bulb temperature.
  - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
28. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

### 3.6 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing AHU and air-distribution systems, clean filter housings and install new filters.

END OF SECTION 237413



## SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components. The system shall provide simultaneous heating and cooling. The system shall be variable refrigerant flow (VRF) or variable refrigerant volume (VRV) Technology.

#### 1.3 DEFINITIONS:

- A. VRF: Variable Refrigerant Flow Systems.
- B. VRV: Variable Refrigerant Volume Systems.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: Required for submission of equipment and systems in substitution to basis of design. Provide VRF systems to comply with performance requirements and design criteria of the basis of design, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate requirements for equipment capacities based on building load and characteristics. Provide load calculations used to determine equipment capacities.
  - 2. Equipment Selections: Provide schedule and layout of equipment based on Design Calculations. Including actual system capacities based on system characteristics, electrical characteristics, refrigerant pipe length and size, duct size, filters, and supply fan static pressure requirements.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty. Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Seven year(s) from date of Substantial Completion.
    - b. For Parts: Five year(s) from date of Substantial Completion.
    - c. For Labor: One year(s) from date of Substantial Completion.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set(s) for each air-handling unit.
  - 2. Gaskets: One set(s) for each access door.
  - 3. Fan Belts: One set(s) for each air-handling unit fan.

## 1.8 COORDINATION

- A. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at 1/4" = 1'-0" scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved: (Submit 3 hard copies of all documents to Architect for Review):
  - 1. Equipment installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to layout.
  - 2. Suspended ceiling components.
  - 3. Structural members to which equipment will be attached.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Penetrations of smoke barriers and fire-rated construction.
  - 6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.9 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or Delegated Design based on comparable product by one of the following:
  - 1. Samsung (Basis of Design).
  - 2. Mitsubishi Electric & Electronics USA, Inc.
  - 3. Daikin.
- C. If a manufacturer other than basis of design is proposed and approved, any additional material, cost, and labor to install additional refrigerant lines, fittings, or other required components shall be incurred by the installing contractor. The installing contractor shall be responsible for additional costs incurred by other contractors and subcontractors as a result of installing an alternate manufacturer's system. The installing contractor must provide complete drawings and documentation identifying all differences between the alternate manufacturer and the basis-of-design system, subject to Engineer's approval. All costs associated with reviewing and approving these drawings and documentation shall be incurred by the installing contractor at the Engineer's hourly rate.

### 2.2 OUTDOOR UNIT

- A. The outdoor unit shall be equipped with multiple circuit boards that shall perform all functions necessary for operation. The outdoor unit shall have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
  - 1. Both refrigerant lines from the outdoor unit to indoor unit shall be insulated.
  - 2. The outdoor unit shall have an accumulator.
  - 3. The outdoor unit shall auto-restart after power loss.
  - 4. The outdoor unit shall have a high pressure safety switch, fuse, over-current protection, over-voltage protection, temperature limit protection logic, compressor overload sensing, and crank case heater.

5. The outdoor unit shall be capable of operating in outside ambient temperatures between -4°F to 122°F in cooling mode with optional wind baffle accessory (see “accessories” section). Cooling only units shall be capable of operating in outside ambient temperatures down to -40°F in cooling mode with optional wind baffle accessory.
  6. Heat pump outdoor units shall be capable of operating in outside ambient temperatures between -13°F to 75°F in heating mode without additional low ambient controls.
  7. The control circuit between the indoor units, and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, two-core, 16 AWG, shielded cable.
  8. The outdoor unit shall supply power to indoor unit via 14 AWG X 3 power wire
  9. The outdoor unit shall have a snow accumulation prevention option setting to prevent snow drifting against an idle outdoor unit.
  10. The outdoor unit shall have a night time quiet mode option to reduce operating sound during the night (12,000 btu/h and 18,000 btu/h models: automatic activation, 24,000 btu/h and larger models: automatic or manual activation with dry contact signal).
  11. The heat pump outdoor unit shall have a base pan heater as standard.
- B. Unit Cabinet
1. The chassis shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.
  2. Pipe connections at the outdoor unit shall be made inside the unit chassis. Refrigerant pipes can exit through the front, side, rear, or bottom sides of the outdoor unit.
- C. Fan
1. Outdoor units shall be furnished with one (1) direct drive or two (2) direct drive, variable speed propeller type fan(s).
  2. All fan motors shall be BLDC type.
  3. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
  4. The fan motor shall be mounted for quiet operation.
  5. The fan shall be provided with a raised guard to prevent contact with moving parts.
  6. The outdoor unit shall have horizontal discharge airflow.
- D. Refrigerant
1. The condensing unit shall require R32 refrigerant.
  2. The condensing unit come charged for system line set lengths up to 25 feet. Additional refrigerant is required if the system line set length is over 25 feet.
  3. The condensing unit shall contain a single EEV (electronic expansion valve) to control refrigerant flow to the indoor unit.

- E. Coil
  - 1. The outdoor coil shall be aluminum, flat fin, micro channel.
  - 2. The coil shall be protected with an integral guard.
  - 3. Refrigerant flow from the outdoor unit shall be controlled by means of a capacity modulation capable, inverter driven, twin BLDC rotary compressor.
- F. Compressor
  - 1. The compressor shall be an inverter driven, DC voltage, twin BLDC rotary compressor made by Samsung.
  - 2. A crankcase heating device shall be factory mounted in/on the compressor.
  - 3. The outdoor unit compressor shall have a variable modulation technology to modulate capacity.
  - 4. The compressor shall be equipped with an internal thermal overload.
  - 5. The compressor shall be mounted to avoid the transmission of vibration.
- G. Electrical
  - 1. The outdoor unit shall be controlled by integral microprocessors.
  - 2. The control circuit between the indoor units and the outdoor unit shall be 0.5VDC - 7VDC completed using stranded, annealed copper conductor, 16 AWG, shielded, two-core cable to provide total integration of the system.
  - 3. The outdoor unit shall provide power to the indoor unit with 14 AWG X 3 power wire (2 X high voltage wires, 1 X ground). The power wire shall be run from the condensing unit to indoor unit.

## 2.3 HORIZONTAL CONCEALED DUCTED INDOOR UNITS

- A. General:
  - 1. The indoor unit shall be a high-performance, high static pressure capable, concealed ducted indoor fan coil that mounts above the ceiling with a fixed horizontal discharge supply. The high static pressure capable, concealed ducted indoor unit shall support individual control.
  - 2. The indoor unit shall be factory assembled, wired, and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, condensate pump, and fan motor.
  - 3. The indoor unit shall include an internal condensate pump with check valve as standard with a maximum vertical lift of 29 inches.
  - 4. The indoor unit shall have an integral condensate float switch to disable the unit in the event of condensate overflow.
  - 5. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function.
  - 6. The indoor unit refrigerant pipes shall be charged with dehydrated air (Nitrogen gas) before shipment from the factory.
- B. Unit Cabinet
  - 1. The unit shall be space saving, ceiling concealed, ducted.
  - 2. The cabinet shall be constructed of insulated galvanized steel.
  - 3. The indoor unit shall allow service access from third sides.

- C. Fan
  - 1. The indoor unit shall have smart-tuning function that can provide optimized comfort by allowing the occupant to offset the fan CFM curve with a wired controller to increase or decrease airflow.
  - 2. Fan assemblies shall have two Sirocco fans direct driven by two (2) fan motors.
  - 3. The indoor fan shall consist of (3) speeds, Low, Mid, and High.
  - 4. The fan speed shall be adjustable by remote controller according to external static pressure.
  - 5. The indoor unit shall have a ducted air outlet system and ducted return air system.
  - 6. The indoor unit shall have static pressure scanning for simple setup and optimized comfort settings for the occupant.
- D. Filter
  - 1. Return air shall be filtered by means of a standard factory installed return air filter.
- E. Coil
  - 1. The indoor coil shall be of nonferrous construction with slit fins on copper tubing.
  - 2. Aluminum coil fins shall be coated with hydrophilic/protective coating to promote moisture shedding.
  - 3. The tubing shall have inner grooves for high efficiency heat exchange.
  - 4. All tube joints shall be brazed with phos-copper or silver alloy.
  - 5. The coils shall be pressure tested at the factory.
  - 6. A condensate pan with drain pump shall be provided under the coil.
  - 7. The coil fins shall be coated with hydrophilic paints.
  - 8. The condensate lift mechanism shall be capable of raising drain water 29 inches above the condensate pan with built-in check valve and float switch.
  - 9. Both refrigerant lines to the indoor unit shall be insulated.
- F. Electrical
  - 1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz supplied from the condensing unit.
  - 2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).
  - 3. The indoor unit PCB shall contain a time-lag fuse.
  - 4. The control circuit between the indoor unit and the outdoor unit shall be 0.5VDC – 7VDC completed using stranded, annealed copper conductor, 16 AWG, shielded, two-core cable to provide total integration of the system.
  - 5. The indoor unit shall have a thermal fuse under high-voltage terminal block to disable unit in the event of overheating due to electrical malfunction / poor connection.

## 2.4 CONTROLS

- A. General:
  - 1. The DVM S Controls Network Solution shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

- B. Electrical Characteristics:
1. General:
  2. Local DVM S Controls Solution devices shall operate at 12V DC. Controller power and communications shall be via a common communications bus.
  3. Central DVM S Controls Solution devices shall communicate via a common central layer communications bus.
- C. Wiring:
1. Main system control wiring (COM1, F1/F2) shall be installed in a system daisy chain configuration from the indoor equipment to MAIN outdoor unit. This cable shall be 16 AWG X 2, shielded cable.
  2. Zone control wiring (COM2, F3/F4) to wired remote controllers (MWR-\*\*\*\*\*N) shall be run from the indoor unit terminal block to the controller associated with that unit. This cable shall be 16 AWG X 2, shielded cable.
  3. Control wiring for system controllers and centralized controllers (upper level) shall be installed in a daisy chain configuration from main condensing unit to main condensing unit (R1/R2), to system controllers.
  4. Communication wire connection (OF1/OF2) between main outdoor unit modules (systems with 2 or more modules) must be connected from the MAIN unit to SUB1 and SUB2 (where applicable). This wire shall be 2-conductor, 16 AWG X 2, shielded cable.
  5. MST-P3P (S-NET 3 software) shall be capable of being networked with up to 16: MIM-D00AN (DMS2), MIM-D01AUN (DMS2.5), MIM-B17N (BACnet gateway 2.0), MIM-B17BUN (BACnet gateway 2.5), MIM-B18 (LonWorks gateway 2.0), and/or MIM-B18BUN (Lon Works gateway 2.5) system controllers for web/LAN based control for consolidated control.
- D. Wiring type:
1. COM1 and COM2 control wiring shall be 2-conductor, 16 AWG X 2, shielded cable.
  2. Network wiring shall be CAT-5e with RJ-45 connection.
- E. DVM CONTROL NETWORK SOLUTION
- F. General:
1. The SAMSUNG DVM S NASA Control Network Solution consists of remote controllers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The SAMSUNG DVM S NASA Control Network Solution shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.

## 2.5 CAPACITIES AND CHARACTERISTICS

- A. Unit and System Capacities:
1. Refer to schedule on drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- D. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems".
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables".

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.



- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

#### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

#### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

## SECTION 238223 - UNIT VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes unit ventilators and accessories with the following heating and cooling features:
  - 1. Hydronic heating coil.
  - 2. Direct expansion cooling coil.

#### 1.3 DEFINITIONS

- A. BAS: Building automation system.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for each unit type and configuration.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Details of anchorages and attachments to structure and to supported equipment.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of unit ventilator and cabinets indicated.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Warranty: Special warranty specified in this Section.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For unit ventilators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Unit Ventilator Filters: Furnish spare filter(s) for each filter installed.

## 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## 1.9 COORDINATION

- A. Coordinate layout and installation of unit ventilators and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of wall sleeves for outdoor-air intake and relief dampers.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Compressor failure.
    - b. Condenser coil leak.
  - 2. Warranty Period: Four years from date of Substantial Completion.
  - 3. Warranty Period (Compressor Only): Five years from date of Substantial Completion.
  - 4. Warranty Period (Condenser Coil Only): Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Magic Aire. (basis of design)
  - 2. Trane.
  - 3. Dakin.
- B. General
  - 1. Unit Construction
    - a. The cabinets shall be constructed of 16-gauge zinc-coated steel. All steel surfaces are cleaned, phosphatized, rinsed, and dried before application of final finish paint. The paint shall be applied by an electrostatic powder spray system. The paint shall result in an appliance-grade finish.
    - b. Cabinet end pockets shall be a minimum of 12 inches wide to facilitate piping and service. If less than 12 inches, unit manufacturer shall provide an extended cabinet or piping enclosure.
- C. Floor-Mounted Unit Ventilators
  - 1. Floor-mounted units shall have an integral pipe tunnel for convenient crossover of piping or electrical wiring. The front surface shall consist of one removable panel for quick removal.
  - 2. The unit discharge grille shall be of a double deflection type to throw air in two directions.
  - 3. To prevent entry of small objects into the fan, provide a discharge grille screen for fans located in the line of sight.
  - 4. Units shall have four adjustable leg levelers.
  - 5. End panels shall be factory-installed on the unit.
- D. Ceiling-Mounted Unit Ventilators
  - 1. Ceiling-mounted units shall be constructed with 2 hinged bottom panels for ease of maintenance. Access to filters, controls, and piping shall be easily available through the two bottom panels. All components of the fan/motor assembly must be removable from the bottom of the unit.
  - 2. The discharge opening of the unit shall be fitted with a bar grille as shown on the plans.
  - 3. Recessed units shall be furnished with a trim flange.
  - 4. Units shall have end panels factory installed.
  - 5. Units shall be finished in one of five baked enamel finishes to be selected by the architect.
- E. Fan Board and Motor
  - 1. For quick maintenance, the fan board assembly shall be a single, rigid assembly including fans, fan housing, bearing, and fan shaft.
  - 2. Fan/coil arrangement shall be blow-through design to eliminate debris from falling into the spinning fan. This safety consideration helps prevent personal injury, noise, or equipment damage. The blow-through design shall protect the coil from freezing by placing the coil farther away from the inlet and mixing the room air and fresh air before it blows across the coil. The coil shall be placed near the discharge opening to attenuate fan noise. Units with a draw-through design must provide a discharge grille screen and a face & bypass damper to protect fans in the line of sight.

3. Provide quick connects for the fan motor for easy maintenance and removal.
  4. Motor: All motors shall be Brushless DC (BLDC)/Electronically Commutated Motors (ECM) factory programmed and run tested in units.
    - a. The motor controller shall be mounted in a touch-safe control box with a built-in integrated user interface and LED tachometer.
    - b. If adjustments are needed, motor parameters shall be adjustable through momentary contact switches accessible without factory service personnel on the motor control board.
    - c. Motors shall have a soft ramp between speeds to lessen the acoustics due to sudden speed changes.
    - d. Motors shall be operated at three speeds or with variable speed. The motor will choose the highest speed if there are simultaneous/conflicting speed requests.
    - e. All motors shall have integral thermal overload protection with a maximum ambient operating temperature of 104F and are permanently lubricated.
    - f. Motors shall be capable of starting at 50 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings.
    - g. Motors shall be capable of starting at 50 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings.
  5. Fan Speed Control: wall mount or unit mount fan speed control will provide an interface to factory wiring, including variable speed/High-Medium-Low (HML) control. The control box will contain a line voltage to 24-volt transformer and ECM motor controller
    - a. A unit mounted fan speed switch will be factory wired and electrically tested. The fan speed switch shall open a factory-installed outside air damper when a fan speed is selected and close the outside damper when the fan speed switch is in the OFF position.
    - b. A ship-with, wall mounted fan speed switch shall open a factory-installed outside air damper when a fan speed is selected and close the outside damper when the fan speed switch is in the OFF position.
- F. Fresh Air and Room Air Dampers
1. The unit shall be equipped with a dual blade mixing damper with a compressible seal to ensure proper modulation and mixing of the room air and fresh air.
  2. The damper shall be capable of varying the proportion of mixed air from 100 percent room air to 100 percent fresh air.
  3. Provide an ultra-low leak damper seal made of closed cell EPDM material. Leakage shall be less than 1 percent against 0.5 inches of external static pressure.
  4. Damper shall contain a continuous divider placed between the damper blades to separate the fresh air and room air compartments to prevent blow-through.
- G. Ventilation Performance
1. Unit manufacturer shall provide airflow performance data by specific option and size per AHRI 840-98. If the manufacturer cannot provide AHRI 840 certified airflow data they must provide, at their expense, certified, independent, balancing reports verifying compliance with AHRI 840. These reports shall be submitted to the mechanical engineer for approval.
- H. Drain Pans:
1. Unit drain pan shall be double sloped welded galvanized steel or stainless steel to prevent standing water.
  2. Drain pan will be coated to prevent external condensation during cooling.
  3. Drain connections shall be supplied on both ends of pan for field conversion of slope and drain hand connection if required.

4. Drain pan slope shall be field convertible without removing the coil module.
5. Heating only units shall come equipped with a double sloped drain pan for future cooling needs.
6. Horizontal units shall have drain pan connection centerline located 4.5 in. above the bottom to provide easy piping to condensate disposal system.
7. The drain pan shall be constructed of smooth, corrosion resistant material. The bottom of the drain pan shall be sloped in two planes that pitch the condensate to the drain connection. Stainless steel drain pans shall be provided as an equal to polymer resin drain pans.
8. The condensate drain shall be internally or externally trapped via accepted ASHRAE guidelines.

I. Coils

1. Coils shall be selected in accordance with AHRI 440.
2. Steam Coils
  - a. Steam coils shall be the freeze resistant double tube, distribution type utilizing a tube-in-tube design with a long life copper header. Non-distributing type coils are not acceptable. Ferrous materials in the header are also not acceptable.
3. Hydronic Coils
  - a. Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
4. Direct Expansion Coils
  - a. All DX coils must be supplied with a factory-installed thermal expansion valve sized for the manufacturer's matching remote-condensing unit.
  - b. A DX low temperature limit sensor shall be provided.
  - c. A 24V transformer shall be provided to power the remote-condensing unit.
  - d. Refrigerant access ports shall be factory-supplied on the high and low side for easy refrigerant pressure or temperature testing.

J. Filters: Each unit shall be equipped with a single 1-inch thick, throwaway filter accessible without the removal of the unit front panel.

K. Underwriters Laboratory: Unit Ventilators shall be listed by Underwriters Laboratory, Inc. for the United States and Canada.

## 2.2 CAPACITIES AND CHARACTERISTICS

A. Refer to schedule on drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive unit ventilators for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit ventilator installation.

### 3.2 INSTALLATION

- A. Install unit ventilators to comply with NFPA 90A.
- B. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other mechanical Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
  - 1. Install piping adjacent to machine to allow service and maintenance.
  - 2. Connect piping to unit ventilator factory hydronic piping package. Install piping package if shipped loose.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

### 3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain unit ventilators. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 238223

## SECTION 238239 - CABINET UNIT HEATERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Cabinet unit heaters with centrifugal fans and hot-water, steam, or electric-resistance heating coils.

#### 1.2 DEFINITIONS

- A. CWP: Cold working pressure.
- B. DDC: Direct digital control.
- C. PTFE: Polytetrafluoroethylene plastic.
- D. TFE: Tetrafluoroethylene plastic.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include location and size of each field connection.
  - 4. Include details of anchorages and attachments to structure and to supported equipment.
  - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Samples for Initial Selection: Finish colors for units with factory-applied color finishes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which cabinet unit heaters will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Size and location of initial access modules for acoustical tile.



5. Items penetrating finished ceiling, including the following:
  - a. Lighting fixtures.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
6. Perimeter moldings for exposed or partially exposed cabinets.

B. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Cabinet Unit-Heater Filters: Furnish one spare filter(s) for each filter installed.

### PART 2 - PRODUCTS

#### 2.1 CABINET UNIT HEATERS

- A. Heaters: Factory-assembled and -tested unit complying with AHRI 440.
- 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 UL 2021.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

#### 2.3 COIL SECTION INSULATION

- A. Insulation Materials:
1. Duct-Liner-Type, Glass-Fiber Insulation: ASTM C1071; surfaces exposed to airstream are to have aluminum-foil facing to prevent erosion of glass fibers.
    - a. Thickness: 1/2 inch .
    - b. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.

- c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested in accordance with ASTM E84.
- d. Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.
- e. Airstream Surfaces: Surfaces in contact with the airstream comply with requirements in ASHRAE 62.1.

## 2.4 CABINETS

- A. Material: Steel with baked-enamel finish with manufacturer's custom paint, in color selected by Architect.
  - 1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch-thick galvanized sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  - 2. Control Access Door: Key operated.
  - 3. Extended Piping Compartment: 8-inch-wide piping end pocket.

## 2.5 FILTERS

- A. Minimum Efficiency Reporting Value and Average Arrestance: In accordance with ASHRAE 52.2.
- B. Minimum Efficiency Reporting Value: In accordance with ASHRAE 52.2.
- C. Material:
  - 1. Pleated cotton-polyester media, MERV 7.

## 2.6 COILS

- A. Steam Coil: Copper distributing tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 75 psig.

## 2.7 CONTROLS

- A. Fan and Motor Board: Removable.
  - 1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
  - 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230500 "Common Work Results for HVAC."
  - 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- B. Terminal Controller:
  - 1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
  - 2. Unit Supply-Air Fan Operations:
    - a. Occupied Periods: Fan runs continuously.
    - b. Unoccupied Periods: Fan cycles to maintain setback room temperature.

3. Heating-Coil Operations:

- a. Occupied Periods: Modulate control valve to provide heating if room temperature falls below thermostat set point.
- b. Unoccupied Periods: Start fan and modulate control valve if room temperature falls below setback temperature.

- C. Electrical Connection: Factory-wired motors and controls for a single field connection.

2.8 CAPACITIES AND CHARACTERISTICS

- A. Electrical Characteristics for Single-Point Connection:
  - 1. See plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINET UNIT HEATERS

- A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."
- B. Install cabinet unit heaters to comply with NFPA 90A.
- C. Suspend cabinet unit heaters from structure with elastomeric hangers.
- D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Section 232116 "Hydronic Piping Specialties," Section 232213 "Steam and Condensate Heating Piping," and Section 232216 "Steam and Condensate Heating Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

- C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
- D. Connect supply and return ducts to cabinet unit heaters with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
- E. Comply with safety requirements in UL 1995.
- F. Unless otherwise indicated, install union and gate or ball valve on steam-supply connection and union, strainer, steam trap, and gate or ball valve on condensate-return connection of cabinet unit heater. Steam specialties are specified in Section 232216 "Steam and Condensate Heating Piping Specialties."
- G. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- H. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

#### 3.5 ADJUSTING

- A. Adjust initial temperature set points.

#### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

END OF SECTION 238239

## SECTION 238316 - RADIANT-HEATING HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes radiant-heating piping for the snowmelt system, including pipes, fittings, and piping specialties.

#### 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. PEX: Crosslinked polyethylene.
- C. PEX/AL/PEX: Crosslinked polyethylene/aluminum/crosslinked polyethylene.
- D. PTFE: Polytetrafluoroethylene plastic.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data for piping, fittings, manifolds, specialties, and controls; include pressure and temperature ratings, oxygen-barrier performance, fire-performance characteristics, and water-flow and pressure-drop characteristics.
- B. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.
  - 1. Shop Drawing Scale: 1/4 inch = 1 foot (1:50).

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Produced in electronic format (compatible with Autocad 2008) Detailed at 1/4" = 1'-0" scale, double lined. Drawings shall indicate pipe layout and elevation, ductwork layout and elevation, and all equipment with manufacturers' recommended maintenance access. The following items shall be shown and coordinated with each other, using input from installers of the items involved: (Submit 3 hard copies of all documents to Architect for Review):
  - 1. Suspended ceiling components.
  - 2. Structural members to which radiant-heating piping will be attached.
  - 3. Items to be coordinated with the radiant heating system, including but not limited to the following:
    - a. Sidewalks.
    - b. Stairways and handrails.
    - c. Landscaping.
    - d. Site utilities.
    - e. Foundation wall penetrations.
    - f. Footings and foundations.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For radiant-heating piping valves and equipment to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 EPDM PIPE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Watts Radiant, inc.; a Watts Water Technologies company.
- B. Pipe Material: Onix.
- C. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
- D. Fittings: ASTM F 1807, metal insert and copper crimp rings.
- E. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 180 deg F (82 deg C). Burst pressure is greater than 800 psig at 70 deg F.

### 2.2 PRE-INSULATED PEX PIPE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Watts Radiant, inc.; a Watts Water Technologies company.
- B. Characteristics: Dual service pipes within single outer jacket.
- C. Pipe Service Material: PEX plastic bonded to the inside and outside of a welded aluminum tube according to ASTM F 1281.
  - 1. Oxygen Barrier: Limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
  - 2. Fittings: ASTM F 1974, metal insert fittings with split ring and compression nut (compression joint) or metal insert fittings with copper crimp rings (crimp joint).
  - 3. Pressure Temperature Rating: Minimum 100 psig (690 kPa) and 210 deg F (99 deg C).
- D. Outer Jacket Material:
  - 1. Outer Jacket
    - a. Material is corrugated seamless high-density polyethylene (HDPE)
    - b. The HDPE jacket completely encompasses and protects the insulation from moisture and damage.
    - c. The outer jacket shall be cast with a corrugated pattern along its entire length. The corrugation pattern shall provide flexibility in the longitudinal direction and rigidity against radial forces.
    - d. The corrugation shall employ a double walled closed cell construction to provide an extra layer of protection from piercing of the outer jacket.

2. Insulation
  - a. The insulation shall be cross-linked polyethylene closed cell foam with a water absorption after 28 days of less than 1.04 percent.
  - b. All seams of the insulation shall be sealed.
  - c. Insulation shall not be bonded to the service tubing.
  - d. Insulation shall not crush, break or pulverize.
  - e. Insulation R-value is a minimum of 6.0.
3. End Seals
  - a. The piping manufacturer shall supply all end caps.
  - b. End caps are to be installed on each end prior to connecting the service pipes and insulating the field joints.
  - c. Where necessary, the end caps will heat shrink onto the piping outer jacket forming a watertight seal.

## 2.3 ACCESSORIES

- A. Use accessories associated with the installation of the pre-insulated piping system as recommended by from the piping manufacturer.
- B. Protective Casings
  1. Protective casings will be manufactured of high density polyethylene shells with insulation, bolts, nuts, and a sealant compound.
- C. Protective Inspection Chambers
  1. The piping manufacturer will provide the inspection chambers when required by the project construction.
  2. Inspection chambers shall be constructed of shock-resistant high density polyethylene.
  3. Heat shrink seals as provided by the piping manufacturer shall be installed to prevent introduction of water into the vault.
- D. Link seal at foundation wall penetrations.
- E. Exterior, recessed fiberglass manifold enclosures.
- F. Basis of design: Quazite

## 2.4 EPDM PIPE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Watts Radiant, inc.; a Watts Water Technologies company.
- B. Pipe Material: Crosslinked EPDM inner and outer tubes.
- C. Wall Thickness: Minimum 0.125 inch (3.2 mm).
- D. Oxygen Barrier: Ductile aluminum foil layer applied to the inner tube to limit oxygen diffusion through the pipe to maximum 0.10 mg per cu. m/day at 104 deg F (40 deg C) according to DIN 4726.
- E. Reinforcing Braid: Braided-aluminum wire between the inner and outer tube.

- F. Fittings: ASTM F 1807, copper with stainless-steel crimps or clamps.
- G. Pressure/Temperature Rating: Minimum 100 psig (690 kPa) and 180 deg F (99 deg C). Burst pressure is greater than 800 psig at 70 deg F.

## 2.5 DISTRIBUTION MANIFOLDS

- A. Manifold: Stainless steel.
- B. Main Shutoff Valves:
  - 1. Factory installed on supply and return connections.
  - 2. Two-piece body.
  - 3. Body: Brass or bronze.
  - 4. Ball: Chrome-plated bronze.
  - 5. Seals: PTFE.
  - 6. CWP Rating: 150 psig (1035 kPa).
  - 7. Maximum Operating Temperature: 225 deg F (107 deg C).
- C. Manual Air Vents:
  - 1. Body: Bronze.
  - 2. Internal Parts: Nonferrous.
  - 3. Operator: Key furnished with valve, or screwdriver bit.
  - 4. Inlet Connection: NPS 5/8.
  - 5. Discharge Connection: NPS 1/8 (DN 6).
  - 6. CWP Rating: 150 psig (1035 kPa).
  - 7. Maximum Operating Temperature: 225 deg F (107 deg C).
- D. Balancing Valves:
  - 1. Body: Bronze, ball or plug, or globe cartridge type.
  - 2. Ball: Stainless steel.
  - 3. Globe Cartridge and Washer: Brass with EPDM composition washer.
  - 4. Seat: PTFE.
  - 5. Visual Flow Indicator: Flowmeter with visible indication in a clear plastic cap at top of valve.
  - 6. Differential Pressure Gage Connections: Integral seals for portable meter to measure loss across calibrated orifice.
  - 7. Handle Style: Lever or knob, with memory stop to retain set position if used for shutoff.
  - 8. CWP Rating: Minimum 125 psig (860 kPa).
  - 9. Maximum Operating Temperature: 250 deg F (121 deg C).
- E. Zone Control Valves:
  - 1. Body: Bronze, ball type.
  - 2. Ball: Brass or stainless steel.
  - 3. Globe Cartridge and Washer: Brass with EPDM composition washer.
  - 4. Seat: PTFE.
  - 5. CWP Rating: Minimum 125 psig (860 kPa).
  - 6. Maximum Operating Temperature: 250 deg F (121 deg C).
- F. Thermometers:
  - 1. Mount on supply and return connections.
  - 2. Case: Dry type, metal or plastic, 2-inch (50-mm) diameter.
  - 3. Element: Bourdon tube or other type of pressure element.



4. Movement: Mechanical, connecting element and pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Black metal.
7. Window: Plastic.
8. Connector: Rigid, back type.
9. Thermal System: Liquid- or mercury-filled bulb in copper-plated steel, aluminum, or brass stem.
10. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

G. Mounting Brackets: Copper.

## 2.6 PIPING SPECIALTIES

- A. Cable Ties:
1. Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
  2. Minimum Width: 1/8 inch (3 mm).
  3. Tensile Strength: 20 lb (9 kg), minimum.
  4. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
- B. Fasteners/ Routing Support:
1. Foam-board staples.
  2. Single-track railway:
    - a. 13 inch lengths with a break point every 2 inches.
    - b. Capable of tube spacing in 2 inch increments.

## 2.7 CONTROLS

- A. Temperature-control devices and sequence of operations are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine surfaces and substrates to receive radiant-heating piping for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that site conditions are acceptable for installation of the system. Refer to manufacturer's installation manual for information.
  2. Ensure that surfaces and pipes in contact with radiant-heating piping are free of burrs and sharp protrusions.
  3. Ensure that surfaces and substrates are level and plumb.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION OF PRE-INSULATED PIPING SYSTEM

- A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:
1. Watts Radiant R-flex Installation Manual

- B. Below-grade Installation:
1. Pre-insulated piping shall be installed in accordance with manufacturer's recommendations and the details as shown on the contract drawings.
  2. The system shall be installed with the fewest number of underground joints as possible.
  3. An end cap shall be applied at all terminations of the pre-insulated piping system, including all fitting locations to form a watertight seal.
  4. All buried fittings shall be installed, insulated and sealed in accordance with the piping manufacturer's instructions.
  5. Protective Inspection Chamber or Protective Casings are required for all below-grade connections.
- C. Backfill:
1. The pre-insulated piping will be backfilled with clean sand material.
    - a. Install piping below the frost line.
    - b. Minimum vertical distance from the bottom of the piping to the trench floor shall be 4 inches (100 mm).
    - c. Minimum lateral distance from the side of the piping to the trench wall shall be 6 inches (150 mm) for 4.9 inch (125 mm) outer jacket; 7.1 inches (180 mm) for 6.3 inch (160 mm) or 7.9 inch (200 mm) outer jacket.
    - d. Provide a minimum of 6 inches (300 mm) of clean fill over the top of the pre-insulated piping.
    - e. Minimum depth of backfill over the sand is 9.9 inches (250 mm) for pedestrian traffic or 25.6 inches (650 mm) for vehicular traffic.
  2. The balance of the trench can be backfilled with native soil void of stone greater than 2 inches (51 mm) in diameter.
    - a. Caution tape shall be provided in the backfill along the entire length of the trench.

### 3.3 APPLICATIONS

- A. Install the following types of radiant-heating piping for the applications described:
1. Piping in Exterior Pavement: EPDM.
  2. Piping to Exterior manifold enclosures: Pre-insulated PEX.

### 3.4 INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings or coordination drawings.
- B. Install radiant-heating piping continuous from the manifold through the concrete slabs and back to the manifold without piping joints in concrete slabs.
- C. Connect radiant piping to manifold in a reverse-return arrangement.
- D. Do not bend pipes in radii smaller than manufacturer's minimum bend radius dimensions.
- E. See Section 232113 "Hydronic Piping" for pipes and connections to hydronic systems and for glycol-solution fill requirements.

- F. Fire- and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials according to Section 078413 "Penetration Firestopping."
- G. Piping in Exterior Concrete:
  - 1. Secure piping in concrete floors by attaching pipes to reinforcement using cable ties.
  - 2. Space cable ties a maximum of 18 inches (457 mm) o.c. and at center of turns or bends.
  - 3. Maintain 3-inch (75-mm) minimum cover.
  - 4. Provide a sleeve of 3/8-inch- (9.5-mm-) thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches (250 mm) on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
  - 5. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
- H. Piping in Interior Concrete:
  - 1. Secure piping in concrete floors by attaching pipes to railway or stapling to rigid insulation.
  - 2. Space railways/staples a maximum of 18 inches o.c. and at center of turns or bends
  - 3. Maintain 3-inch minimum cover.
  - 4. Maintain minimum 40-psig (275-kPa) pressure in piping during concrete placement and continue for 24 hours after placement.
- I. After concrete has cured as recommended by concrete supplier, operate radiant-heating system as follows:
  - 1. Start system heating at a maximum of 10 deg F (6 deg C) above the ambient radiant-panel temperature and increase 10 deg F (6 deg C) each following day until design temperature is achieved.
  - 2. For freeze protection, operate at a minimum of 60 deg F (16 deg C) supply-water temperature.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare radiant-heating piping for testing as follows:
  - 1. Open all isolation valves and close bypass valves.
  - 2. Open and verify operation of zone control valves.
  - 3. Flush with clean water and clean strainers.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig (690 kPa). Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Radiant-heating piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Protect hydronic piping system from damage during construction.

END OF SECTION 238316

## SECTION 23 9119 - FIXED LOUVERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fixed extruded-aluminum louvers.
  - 2. Blank-off panels for louvers

#### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing according to AMCA 540.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

## 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

### 2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal:
  - 1. Greenheck.
  - 2. Reliable.
- B. Horizontal Drainable-Blade Louver:
  - 1. Louver Depth: 2 inches.
  - 2. Frame and Blade Nominal Thickness: Not less than 0.080 inch for blades and 0.080 inch for frames.
  - 3. Mullion Type: Exposed.
  - 4. Louver Performance Ratings:
  - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

### 2.3 LOUVER SCREENS

- A. General: Provide screen at louvers indicated.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: insect screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
  - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached.
  - 2. Finish: Same finish as louver frames to which louver screens are attached.

### 2.4 BLANK-OFF PANELS

- A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
  - 1. Thickness: 2 inches.
  - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
  - 3. Insulating Core: extruded-polystyrene foam.

4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inch nominal thickness, with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
6. Panel Finish: Same type of finish applied to louvers, but black color.
7. Attach blank-off panels with sheet metal screws.

## 2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B22, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.
- D. Fasteners: Use types and sizes to suit unit installation conditions.
  1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  2. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
  3. For fastening stainless steel, use 300 series stainless-steel fasteners.
  4. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

#### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 239119

## SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Training
  - 2. System Commissioning and Testing.
  - 3. Electrical demolition.
  - 4. Cutting and patching for electrical construction.
  - 5. Touchup painting.

## 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Contractor shall provide U.L. labels as required for all new and existing equipment which will be reworked or modified from its original condition under this contract.
- C. Comply with NFPA 70.

## 1.4 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 08 Section "Access Doors."
- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.



## 1.5 TRAINING

- A. Prior to acceptance of all systems and equipment, the contractor, along with his subcontractors and vendors, shall instruct and train the owner's representatives on the operation and maintenance of all aspects of the new systems. Owner has to be given ample time to schedule training dates and personnel. Training sessions shall be given at intervals of 4 hours long. Training literature for startup procedures and maintenance shall be included in the O & M Manuals.

## 1.6 SYSTEM COMMISSIONING AND TESTING

- A. Prior to completion and acceptance of new or renovated areas, all electrical installations and systems shall be tested, balanced and operated to demonstrate to the Owner or his representative and Architect/Engineer that the installation and performance of each electrical system conforms to the requirements of the drawings and specifications.
- B. Tests of electrical system shall be made as equipment and shall include a run under full load (or a reasonable overload) long enough to determine that no excessive heat will be developed at terminal points, switches, and other points of installation.
- C. A written report of performance tests on the specific electrical systems and equipment shall be supplied to the Owner. Such tests shall show compliance with the governing codes regulations.
- D. Engage a certified New York Board of Underwriters inspector to inspect and certify compliance upon completion of work. All electrical installations and products used on this project shall comply with the National Electrical Manufacturer's Association (NEMA) and the National Electrical Code (NEC).

## PART 2 - PRODUCTS

### 2.1 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

### 3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- H. Simultaneously install vertical conductor supports with conductors.
- I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- J. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Steel: Welded threaded studs or spring-tension clamps on steel.

- a. Field Welding: Comply with AWS D1.1.
- 6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
- 7. Light Steel: Sheet-metal screws.
- 8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### 3.4 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Install through-penetration firestop systems to comply with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contract and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.5 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

### 3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Supporting devices for electrical components.
  - 2. Concrete bases.
  - 3. Cutting and patching for electrical construction.
  - 4. Touchup painting.

### 3.8 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 09 Section "Painting."
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.9 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260500

## SECTION 260511 – MECHANICAL, ELECTRICAL AND PLUMBING COORDINATION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 WORK INCLUDED

- A. Work included in this section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
  - 1. Motors.
  - 2. Factory-wired equipment (FEW).
  - 3. Factory-wired control panels (FWCP).
  - 4. Motor controllers where provided as part of mechanical equipment.
  - 5. Motor controllers where supplied under Division 23 – Mechanical Work.
  - 6. Disconnects and safety switches for mechanical equipment.
  - 7. Fuses for equipment provided, and starters and disconnect switches.

## 1.3 REFERENCE STANDARDS

- A. Published specification standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
  - 1. ANSI – American National Standards Institute.
  - 2. NEMA – National Electrical Manufacturer's Association.
  - 3. IEEE – Institute of Electrical and Electronic Engineers.

## 1.4 CODE COMPLIANCE

- A. All work shall be performed in compliance with the following:
  - 1. Building Code of New York State (2025).
  - 2. Mechanical Code of New York State (2025).
  - 3. Fuel Gas Code of New York State. (2025)
  - 4. Plumbing Code of New York State (2025).
  - 5. Fire Code of New York State (2025).
  - 6. Energy Conservation Construction Code of New York State (2025).
  - 7. National Electrical Code (NEC). (2023)
  - 8. Occupational Safety and Health Administration (OSHA). Latest Edition.
  - 9. Local Codes and Ordinances of the City of Buffalo and Erie County.
  - 10. Life Safety Codes, NFPA 101.
  - 11. New York Board of Fire Underwriters.
  - 12. Combustion Toxicity Amendment to the New York State Uniform Fire Prevention and Building Code.
  - 13. Underwriters Laboratories.
  - 14. ASHRAE 15 Safety Code for Mechanical Refrigeration.

## 1.5 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.04 of this Section and with all applicable National, State and local codes.
- D. All items of a given type shall be the products of the same manufacturer.

## 1.6 DIVISION OF WORK

- A. This section delineates the work required to be performed by contractors under Divisions 23 and 26.

## 1.7 WORK REQUIRED UNDER DIVISION 22

- A. Furnish motors, manual and combination starters, contactors, disconnect switches, and other electrical devices required for equipment furnished under Division 22. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 26. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers. Single phase starters shall be manual thermal switches with pilot lights and properly sized heaters. Thermostats, aquastats, controls and control wiring shall be included under Division 22 contractor.
- B. Install all items in piping and ductwork such as aquastats, etc.
- C. All external wiring of equipment, all control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 26. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 22 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Water Heater and Comminuter: The water heater and comminuter shall be provide by the Plumbing Contractor. Provision of the flue vents and accessories along with the control for the comminuter shall be by the Plumbing Contractor under Division 22.

## 1.8 WORK REQUIRED UNDER DIVISION 23

- A. Furnish motors, manual and combination starters, contractors, and other electrical devices required for equipment furnished under Division 23. All manual and combination starters, disconnect switches, electrical thermostats shall be installed by the Electrical Contractor, under Division 26. Combination starter/disconnect shall be similar to Allen Bradley 512 with properly sized control transformers for control components. Include hand-off-auto switches with lights. Single phase starters shall be thermal switches with pilot light and properly sized heaters. All loose VFD's shall be furnished and installed by the Temperature Control Contractor.

- B. Install all items in piping and ductwork such as aquastats, ductstats, etc.
- C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring and mounting of control devices, etc., shall be included and provided under Division 23. All external wiring shall be in conduit (unless specifically shown to be provided by the Electrical Contractor).
- D. Wiring required under Division 23 shall comply with the specifications as described in Division 26.
- E. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to supply units.)
- F. Furnish fuses for all equipment provided by the Mechanical Contractor.

#### 1.9 WORK REQUIRED UNDER DIVISION 26

- A. The Electrical Contractor, under Division 26, shall provide all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be responsible for proper direction of rotation for all three-phase equipment. The Electrical Contractor shall mount all starters, disconnects.
- B. The Electrical Contractor shall provide disconnect switches (sized as required) or thermal switches with pilot lights, on all mechanical equipment not furnished by Division 23 and as required by the National Electrical code, when equipment is not supplied with same.
- C. The Electrical Contractor shall provide single – or three-phase AC power, as required, to all mechanical equipment provided and installed by Division 23.
- D. All control devices (thermostats, etc.) required for mechanical equipment operation shall be provided, installed, and wired by the respective Mechanical Contractor.
- E. The Electrical Contractor shall disconnect all existing power connections to mechanical equipment prior to removal of equipment by others.
- F. The Electrical Contractor shall not purchase materials or initiate roughing work of electrical connections to equipment provided by other Contractors until receipt of reviewed submittals and coordination is completed.

#### 1.10 STORAGE

- A. It shall be the contractor's responsibility to provide secure storage of new equipment and contractor's belongings at the construction site. Any equipment lost or damaged prior to acceptance by the owner shall be replaced with new equipment at no cost to the owner.

#### 1.11 RECORD DRAWINGS AND MAINTENANCE MANUALS

- A. Refer to Division 01.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

#### A. Motor Controllers and Disconnects:

1. Square D
2. Allen-Bradley
3. Eaton/Cutler-Hammer
4. General Electric

### 2.2 SAFETY SWITCHES

- #### A.
- Refer to Specification Section 262816, "Enclosed Switches and Circuit Breakers" for requirements.

### 2.3 NAMEPLATES

- #### A.
- A.Phenolic Type: Standard phenolic nameplates with 3/8" minimum size lettering engraved thereon to match existing. Adhesive backing.

## PART 3 - EXECUTION

### 3.1 GENERAL

- #### A.
- Equipment shall be connected in a neat and skillful manner. Equipment delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions by the Mechanical Contractor furnishing the equipment.
- #### B.
- All equipment shall be grounded with a green covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end. All electrical work required in the Mechanical Contracts shall conform to the applicable requirements of Division 26 of these Specifications.
- #### C.
- The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.
- #### D.
- Install heaters correlated with full load current of motors provided.
- #### E.
- Set overload devices to suit motors provided

### 3.2 INSTALLATION

#### A. Control Wiring:

1. Provide control wiring and connections.
2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).



- B. Nameplates: Adhere the nameplate on the cover of NEMA 1 or 3R enclosures. Provide phenolic nameplates as follows:
  - 1. On each remote-control station, indicating motor controlled.
  - 2. On each disconnect switch, indicating purpose of switch.

### 3.3 DISCONNECTS

- A. Motor Controllers: Provide safety switch for all motor controllers.
- B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.
- C. Provide safety switches for all factory packaged equipment.
- D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.
- E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc.

END OF SECTION 260511

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2 and Type SO.

#### 2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

#### 2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- I. Branch Circuits Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- J. Class 1 control Circuits: Type THHN-THWN, in raceway.
- K. Class 2 Control Circuits: Type THHN-THWN, in raceway, Power-limited cable, in raceway.
- L. 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 OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "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."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

- B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
  2. Results that comply with requirements.
  3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
- B. All grounding shall be in strict accordance with the NEC Article 250.
- C. A building grounding system shall be provided with methods and materials in accordance with applicable codes and standards and able to limit potential differences between grounding conductors, raceways and enclosures. The complete building grounding system will consist of the following:
  - 1. Facility Grounding: A central point of ground shall be provided for bonding the electrical service ground, signal grounding, building steel grounding and outdoor pad mount transformer grounding.
  - 2. Signal Grounding: Sub points of grounding shall be provided for bonding all electronic equipment in the Telephone and Computer Rooms.
  - 3. Piping System Grounding: Bonding of all metallic piping systems in the building (fire protection, water, gas, air, hydraulic, etc.) to the facility ground.
  - 4. Transformer Secondary: Bonding of all separately derived electrical systems (transformers).
  - 5. Equipment Grounding: Grounding conductor path provided for interconnection of non-current carrying parts of electrical equipment and fixtures.
  - 6. Panelboard Grounding: Bonding jumper from raceway grounding bushing to panelboard ground bus.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Ground rods.
  - 2. Grounding arrangements and connections for separately derived systems.
  - 3. Grounding for sensitive electronic equipment.
- C. Field quality-control test reports.

- D. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
  - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
    - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    - b. Include recommended testing intervals.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTORS

- A. Insulated Conductors: 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. Bare Grounding Conductor and Conductor Protector for Wood Poles:
  - 1. No. 4 AWG minimum, soft-drawn copper.
  - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

## 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
  - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
  - 2. Backfill Material: Electrode manufacturers' recommended material.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- E. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Structural Steel: Welded connectors.



### 3.2 SWIMMING POOL GROUNDING AND BONDING

- A. All electrical equipment installed in the water, walls or deck of the swimming pool shall be installed in compliance the latest edition of the National Electric Code.
- B. The following parts shall be bonded together:
  - 1. All metallic parts of the pool structure, including the reinforcing steel, steps, ladders, etc.
  - 2. Conductive pool shells. Poured concrete, pneumatically applied or sprayed concrete and concrete block with painted or plastered coatings shall all be considered conductive materials.
  - 3. Perimeter surfaces. The perimeter surface shall extend for three (3) feet horizontally beyond the inside walls of the pool and shall include unpaved surfaces, as well as poured concrete surfaces. Perimeters less than three (3) feet separated by a permanent wall or building five (5) feet high in height or more shall require equipotential bonding on the pool side of the permanent wall or building. Bonding to the perimeter surfaces shall be attached to the pool reinforcing steel or copper conductor grid at a minimum of four (4) points uniformly spaced around the perimeter of the pool.
  - 4. All forming shells and mounting brackets.
  - 5. All metal fittings within or attached to the pool structure.
  - 6. Metal parts of electrical equipment associated with the pool water circulation system, including pump motors.
  - 7. Metal conduit and metal piping with five (5) feet of the inside walls of the pool and that are not separated from the pool by permanent barrier.
  - 8. All fixed metal parts that are with five (5) feet of the inside walls of the pool and not separated from the pool area by a permanent barrier that prevents contact by a person.
  - 9. All fixed parts that are within twelve (12) feet measured vertically above the maximum water level or measured vertically above any stands, towers, platforms or any diving structures.
- C. The above parts shall be connected to a common bonding grid with a No. 8 solid copper conductor and connections shall be made with pressure connectors, clamps, or approved other methods. The common bonding grid may be:
  - 1. The structural reinforcing steel, where the reinforcing rods are bonded together by steel wire ties; or
  - 2. A solid copper conductor not smaller than No. 8.
- D. The following equipment shall be grounded:
  - 1. All electrical equipment with five (5) feet of the inside wall of the pool.
  - 2. All electrical equipment associated with the recirculating system of the pool.
  - 3. Junction boxes.
  - 4. Transformer and power supply enclosures.
  - 5. Ground fault interrupters.
  - 6. Panelboards that supply any electric equipment associated with the pool.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.

2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
  8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- G. Metal and Wood 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.
- ### 3.3 INSTALLATION
- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Existing Grounding:
1. The Contractor shall remake all grounds disturbed by new construction or renovation.
  2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.
- ### 3.4 FIELD QUALITY CONTROL
- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. 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 not less 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.
  3. Prepare dimensioned drawings locating each ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- B. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
  - 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
- C. 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 SUMMARY

- A. Section includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

#### 1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Atkore International.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported. Perforated hangers or wire-tie supports are not acceptable. All hangers and supports shall have corrosion resistant finish.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 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 in which used.
  - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Cooper B-Line, Inc.
    - 2) Empire Tool and Manufacturing Co., Inc.
    - 3) Hilti, Inc.
    - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-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, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."



C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.

#### 1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
- D. Source quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 4. Maverick Tube Corporation.
  - 5. O-Z Gedney; a unit of General Signal.
  - 6. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Coordinate first subparagraph below with Drawings.
  - 2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
  - 3. Fittings for EMT: Steel, set-screw type.
  - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

### 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. Condux International, Inc.

6. ElecSYS, Inc.
7. Lamson & Sessions; Carlon Electrical Products.
8. RACO; a Hubbell Company.
9. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-80-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

## 2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum installation.

## 2.4 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, 3R, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type Flanged or gasketed type, as indicated.

E. Finish: Manufacturer's standard enamel finish.

## 2.5 NONMETALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- C. Fittings and Accessories: Include 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.

## 2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems Division.
    - b. Lamson & Sessions; Carlon Electrical Products.
    - c. Panduit Corp.
    - d. Walker Systems, Inc.; Wiremold Company (The).
    - e. Wiremold Company (The); Electrical Sales Division.

## 2.7 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. Robroy Industries, Inc.; Enclosure Division.
  - 8. Thomas & Betts Corporation.
  - 9. Walker Systems, Inc.; Wiremold Company (The).
  - 10. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

- E. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- J. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## 2.8 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.9 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
  2. Concealed Conduit, Aboveground: Rigid steel conduit.
  3. Underground Conduit: Rigid steel conduit or RNC, Type EPC 80 PVC, direct buried.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Areas used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Areas used for vehicle traffic/maintenance garage.
    - d. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: Rigid steel conduit.
  7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway or EMT.
  8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway or EMT.
  9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Change from ENT to rigid steel conduit, or IMC before rising above the floor.
- I. 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.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. 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.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway 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.



- M. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:
    - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    - 2. Where otherwise required by NFPA 70.
  - N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
    - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
      - 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 the Outdoors without Physical Separation: 125 deg F temperature change.
      - d. Attics: 135 deg F temperature change.
    - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
    - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
  - O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, 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.
  - P. 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.
  - Q. Set metal floor boxes level and flush with finished floor surface.
  - R. 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 Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
    - 2. Install backfill as specified in Division 31 Section "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 Division 31 Section "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

### 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

### 3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

## SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.

- B. Related Requirements:

- 1. Section 078413 "Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES

- A. Wall Sleeves:

- 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
  - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
  - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. CALPICO, Inc.
  - c. Metraflex Company (The).
  - d. Pipeline Seal and Insulator, Inc.
  - e. Proco Products, Inc.
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  - 2. Sealant shall have VOC or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 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. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

#### 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.



- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high letters on 20-inch centers.
- D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- E. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.
- F. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

### 2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

### 2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

## 2.4 UNDERGROUND-LINE WARNING TAPE

### A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

### B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

### C. Tag:

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, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 lb/1000 sq. ft.
5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

## 2.5 WARNING LABELS AND SIGNS

### A. Comply with NFPA 70 and 29 CFR 1910.145.

### B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

### C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

### D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.8 CABLE TIES

- A. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.

## 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

### 3.2 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
  - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
  - 2. Wall surfaces directly external to raceways concealed within wall.
  - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways, More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot 30-foot maximum intervals.
- C. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. Emergency Power.
  - 2. Power.
  - 3. UPS.

- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- F. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
- G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels or baked-enamel warning signs.
1. Comply with 29 CFR 1910.145.
  2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.
- O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  2. Equipment to Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Switchgear.
    - e. Switchboards.
    - f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    - g. Substations.
    - h. Emergency system boxes and enclosures.

- i. Motor-control centers.
- j. Enclosed switches.
- k. Enclosed circuit breakers.
- l. Enclosed controllers.
- m. Push-button stations.
- n. Power transfer equipment.
- o. Contactors.
- p. Remote-controlled switches, dimmer modules, and control devices.
- q. Battery-inverter units.
- r. Battery racks.
- s. Power-generating units.
- t. Monitoring and control equipment.

END OF SECTION 260553

## SECTION 26 0923 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Time switches.
  - 2. Photoelectric switches.
  - 3. Indoor occupancy and vacancy sensors.
  - 4. Switchbox-mounted occupancy sensors.
  - 5. Lighting contactors.
  - 6. System Commissioning and Testing
- B. Related Requirements:
  - 1. Section 262726 "Wiring Devices" for wall-box dimmers, 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. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which equipment will be attached.
  - 3. Items penetrating finished ceiling, including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Control modules.
- B. Field quality-control reports.



## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

## 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 TIME SWITCHES

- A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
  - 1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
  - 2. Contact Configuration: As noted on Drawings.
  - 3. Contact Rating: 20-A ballast load, 120-/277-V ac.
  - 4. Programs: Two (2) channels; each channel is individually programmable with 40 on-off operations per week, plus four seasonal schedules that modify the basic program and an annual holiday schedule that overrides the weekly operation on holidays.
  - 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
  - 6. Astronomic Time: Selected channels.
  - 7. Automatic daylight savings time changeover.
  - 8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

### 2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with SPST dry contacts rated for 1000 W incandescent or 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
  - 3. Time Delay: Fifteen-second minimum, to prevent false operation.
  - 4. Surge Protection: Metal-oxide varistor.
  - 5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
  - 6. Failure Mode: Luminaire stays ON.

## 2.3 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Building Automation, Inc.
  2. Leviton Manufacturing Co., Inc.
  3. Lithonia Lighting; Acuity Brands Lighting, Inc.
  4. WattStopper; a Legrand® Group brand.
- B. General Requirements for Sensors:
1. Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
  2. Dual technology.
  3. Separate power pack.
  4. Wireless 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.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; 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 ballast or 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.
  13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

## 2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- 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. Hubbell Building Automation, Inc.
  - 2. Leviton Manufacturing Co., Inc.
  - 3. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 4. WattStopper; a Legrand® Group brand.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Occupancy Sensor Operation: Unless otherwise indicated, manual on and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
  - 4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V.

## 2.5 LIGHTING CONTACTORS

- 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. Allen-Bradley/Rockwell Automation.
  - 2. ASCO: a brand of Vertiv.
  - 3. Eaton.
  - 4. General Electric Company.
  - 5. Square D.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with, complying with NEMA ICS 2 and UL 508.
  - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
  - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  - 3. Enclosure: Comply with NEMA 250.
  - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

## 2.6 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."

- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 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 SENSOR INSTALLATION

- 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 CONTACTOR INSTALLATION

- A. Comply with NECA 1.
- B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

#### 3.4 WIRING INSTALLATION

- 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 according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to 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 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. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.7 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.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

### 3.9 SYSTEM COMMISSIONING AND TESTING

- A. Prior to completion and acceptance of new or renovated areas, all lighting systems and control installation (including occupancy sensors, time switches, daylight sensors, etc.) shall be tested and operation to demonstrate to the Owner or his representative and Architect/Engineer that the installation and performance of each electrical system conforms to the requirements of the drawings and specifications.
  - 1. All testing shall comply with International Conservation Code Section C408.3.
- B. A written report of performance tests on the specific electrical systems and equipment shall be supplied to the Owner. Such tests shall show compliance with International Conservation C408.3.2 and governing code regulations. All documentation is to be provided to the building owner within 90 days of the date of receipt of the certificate of occupancy.

END OF SECTION 26 0923

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
- B. Related Requirements:
  - 1. Section 260573 "Overcurrent Protective Device Coordination/Arc Flash Hazard Analysis" for overcurrent protective device study and arc-flash analysis and arc-flash label requirements.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Preliminary Protective device study:
  - 1. Proposed equipment to be installed shall be coordinated with the preliminary protective coordination device study to ensure that all selections of devices and associated characteristics are satisfactory.
- D. 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.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP)  
Types: Two spares for each panelboard.

#### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

#### 1.6 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.

#### 1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.



2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

- a. Ambient Temperature: Not exceeding 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.

## 1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets.
  1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.
    - c. Wash-Down Areas: NEMA 250, Type 4X stainless steel.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  2. Hinged Front Cover: Entire front hinged to box with standard door within hinged trim cover, trim shall cover all live parts and shall have no exposed hardware.
  3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  4. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  5. Finishes:
    - a. Panels and Trim: 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: Same finish as panels and trim.
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
  6. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

- B. Incoming Mains Location: Top and bottom.
- C. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.2 DISTRIBUTION PANELBOARDS

- 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 Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder 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 and Lugs only.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- 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 Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider 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. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

#### 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE 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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. 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 100 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip for circuit breakers 250A and larger; and the following field-adjustable settings:

- a. Instantaneous trip.
- b. Long- and short-time pickup levels.
- c. Long- and short-time time adjustments.
- d. Ground-fault pickup level, time delay, and  $I^2 t$  response.

4. Arc Energy Reduction: Circuit breaker frame sizes 1200A and larger:

- a. Provide Energy-reducing maintenance switching with local status indicator to comply with NEC 240.87.
- b. Provide documentation to demonstrate that the method to reduce clearing time is set to operate at a value below the available arcing current. Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s).

5. Current Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
  - a. Standard frame sizes, trip ratings, and number of poles.
  - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
  - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
  - f. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
  - g. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
  - h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
  - i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
  - F. Install filler plates in unused spaces.
  - G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
  - H. Comply with NECA 1.
- 3.3 IDENTIFICATION
- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
  - B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
  - C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- 3.4 FIELD QUALITY CONTROL
- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
  - B. Perform tests and inspections.
    1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - C. Acceptance Testing Preparation:
    1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
    2. Test continuity of each circuit.

## D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
  - c. Instruments and Equipment:
    - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

## 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  1. Measure as directed during period of normal system loading.
  2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

## 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Wall-switch and exterior occupancy sensors.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Floor service outlets, poke-through assemblies, and multi-outlet assemblies.

#### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
  - 2. Hubbell Incorporated; Wiring Device-Kellems.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.

### 2.3 TAMPER RESISTANT GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, Tamper Resistant 125 V, 20 A, Back and Side Wired: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; TRCR 5362 (duplex)
    - b. Hubbell Incorporated; Wiring Device-Kellems 5352TR (duplex)
    - c. Leviton Manufacturing Co., Inc.; 5352TR (duplex)
    - d. Pass & Seymour/Legrand (Pass & Seymour); 5362 TR (duplex)
- B. Fully Switched Controlled Tamper-Resistant Duplex Receptacles:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems. BR2C2TR series
    - b. Leviton Manufacturing Co., Inc.
    - c. Pass & Seymour
  - 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in



the line voltage receptacle. Provide with markings to identify that the receptacle is controlled.

3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with NEC 406.3(E).

C. Half Switched Controlled Tamper-Resistant Duplex Receptacles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Incorporated; Wiring Device-Kellems. BR2C1TR series
  - b. Leviton Manufacturing Co., Inc.
  - c. Pass & Seymour
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle. Provide with markings to identify which receptacle is controlled.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with NEC 406.3(E).

## 2.4 GFCI RECEPTACLES

A. General Description:

1. Tamper Resistant Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include self-test technology and indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Tamper Resistant Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; TVGF20
  - b. Hubbell Incorporated; Wiring Device-Kellems.; GFTR3252
  - c. Leviton Manufacturing Co., Inc.; TR7590
  - d. Pass & Seymour/Legrand (Pass & Seymour). 2095TR

C. Fully Switched Controlled Tamper-Resistant GFCI Duplex Receptacles, 120 V, 20A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hubbell Incorporated; Wiring Device-Kellems. GFRTR20C2 series
  - b. Leviton Manufacturing Co., Inc.
  - c. Pass & Seymour
2. Description: Provide with markings to identify that the receptacle is controlled.
3. Standards: Comply with NEC 406.3(E).

## 2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; CWL520R
    - b. Hubbell Incorporated; Wiring Device-Kellems; HBL2310
    - c. Leviton Manufacturing Co., Inc.; 2310
    - d. Pass & Seymour/Legrand (Pass & Seymour); L520-R

## 2.6 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A, Back and Side Wired:
  - 1. Single Pole:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH 1221
      - 2) Hubbell Incorporated; Wiring Device-Kellems; 1221
      - 3) Leviton Manufacturing Co., Inc.; 1221-2
      - 4) Pass & Seymour/Legrand (Pass & Seymour); PSAC1
  - 2. Three Way:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1223
      - 2) Hubbell Incorporated; Wiring Device-Kellems; 1223
      - 3) Leviton Manufacturing Co., Inc.; 1223-2
      - 4) Pass & Seymour/Legrand (Pass & Seymour); PS20AC3
- C. Pilot-Light Switches, 20 A:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
    - b. Hubbell Incorporated; Wiring Device-Kellems; HBL 1221-PL
    - c. Leviton Manufacturing Co., Inc.; 1221-PLR (120 v) OR 1221-7PLR (277v)
    - d. Pass & Seymour/Legrand (Pass & Seymour); PS20AC1RPL (120v) or PS20AC1RPL (277v)
  - 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH1221L
  - b. Hubbell Incorporated; Wiring Device-Kellems HBL1221L.
  - c. Leviton Manufacturing Co., Inc.; 1221-2L
  - d. Pass & Seymour/Legrand (Pass & Seymour). PS20AC1-L
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
  - b. Hubbell Incorporated; Wiring Device-Kellems; HBL1557L
  - c. Leviton Manufacturing Co., Inc.; 1257L
  - d. Pass & Seymour/Legrand (Pass & Seymour); 1251L

## 2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces:
  - a. 0.035-inch thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum with lockable cover.

## 2.8 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

## 2.9 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Pass & Seymour/Legrand (Pass & Seymour).
  - 3. Square D; by Schneider Electric.
  - 4. Thomas & Betts Corporation, A Member of the ABB Group.
  - 5. Wiremold / Legrand.
- B. Description:
  - 1. Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
  - 2. Comply with UL 514 scrub water exclusion requirements.
  - 3. Service-Outlet Assembly: Pedestal type with services indicated.
  - 4. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
  - 5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
  - 6. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

## 2.10 PREFABRICATED MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems;
  - 2. Wiremold / Legrand.
- B. Description:
  - 1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
  - 2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Multi-outlet Harness:
  - 1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
  - 2. Receptacle Spacing: 6 inches.
  - 3. Wiring: No. 12 AWG solid, Type THHN copper, two circuit, connecting alternating receptacles.

## 2.11 FINISHES

- A. 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 Emergency Power System: Red.

- B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  - 8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

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, multi-gang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

## SECTION 262813 - FUSES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, enclosed controllers and motor-control centers.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

#### 1.4 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

#### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

## PART 3 - EXECUTION

### 3.1 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK5, time delay.
- B. Other Branch Circuits: Class RK1, time delay.
- C. Control Circuits: Class CC, time delay.

### 3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 262813



## SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Enclosures.

#### 1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Field quality-control reports.
- D. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 FUSIBLE SWITCHES

- 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 Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.

- B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate required fuses, 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. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 4. Lugs: Suitable for number, size, and conductor material.

## 2.2 NONFUSIBLE SWITCHES

- 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 Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240-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.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Lugs: Suitable for number, size, and conductor material.

## 2.3 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Ferraz Shawmut, Inc.
  - 3. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

- 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, connected pilot, and indicating and control devices.
- E. Accessories:
  - 1. Oiltight key switch for key-to-test function.
  - 2. Oiltight green ON pilot light.
  - 3. Isolated neutral lug; 100 percent rating.
  - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  - 5. Form C alarm contacts that change state when switch is tripped.
  - 6. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
  - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS

- 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 Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. 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.
- D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and I<sub>2</sub>t response.
- E. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 5. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - 6. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

## 2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen, Wash-Down, Pool Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

### 3.2 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.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

## SECTION 265100 - 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. Related Sections include the following:
  - 1. Division 26 Section 26 27 26 "Wiring Devices".
  - 2. Division 26 Section 26 09 23 "Lighting Control Devices"
- B. Provide and install items as specified herein and listed on the Lighting Fixture Schedule on the drawings.
- C. Furnish and install all lighting fixtures complete with lamps.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.
- B. CRI: Color rendering index.
- C. CU: Coefficient of utilization.
- D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
  - 1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- E. RCR: Room cavity ratio.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of fixture, including dimensions and verification of indicated parameters.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Photometric data and adjustment factors based on laboratory tests, IES LM-79 and IES LM-80.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Wiring Diagrams: Power, signal, and control wiring.

- D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which lighting-fixture suspension systems will be attached.
  - 3. Other items in finished ceiling, including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Access panels.
    - e. Fire Alarm Devices
  - 4. Perimeter moldings.
- E. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.
- F. Source quality-control test reports.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:
  - 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.
- I. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Obtain exact location of all ceiling outlets from the Architect.
- C. Coordinate all lighting switch locations with Architectural drawings for exact location of doors and door swing prior to roughing in.

#### 1.7 WARRANTY

- A. Special Warranty for LED Fixtures: Manufacturer's standard form, in which the LED fixture manufacturer agrees to repair or replace LED components that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period for LED Fixtures: Five year from date of Substantial Completion.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on drawings.

### 2.2 FIXTURES AND COMPONENTS, GENERAL

- 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. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
- C. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- D. LED Fixtures: Comply with IESNA LM-79, LM-80 and TM-21.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. 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.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass, unless otherwise indicated.
  - 3. lamp life.

### 2.3 LED LIGHTING FIXTURES AND COMPONENTS



- A. LED: Color temperature as indicated on drawings.
- B. CRI 80 (minimum).
- C. Rated minimum life of 50,000 hours to L70.
- D. Drivers: Constant current driver at 350 mA, 100-277V.
- E. ENERGY STAR or DLC certified.

## 2.4 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gauge.
- E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch-minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

## 2.5 FINISHES

- A. Fixtures: Manufacturers' standard, color as selected by Architect, unless otherwise indicated.
  - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  - 2. Metallic Finish: Corrosion resistant.

## 2.6 SOURCE QUALITY CONTROL

- A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Comply with NECA 1
- B. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Support fixtures directly from building structure.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

D. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Continuous Rows: Suspend from cable.

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 structural members in walls or using a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board

G. Adjust aimable fixtures to provide required light intensities.

### 3.2 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 and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- 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.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 26 5100

## SECTION 267150 - VOICE AND DATA COMMUNICATION CABLING

### PART 1 - GENERAL

#### 2.11 RELATED DOCUMENTS

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

#### 2.11 SUMMARY

- A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmission.

#### 2.11 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. LAN: Local area network.
- D. PVC: Polyvinyl chloride.
- E. UTP: Unshielded twisted pair.

#### 2.11 SUBMITTALS

- A. Product Data: Include data on features, ratings, and performance for each component specified.
- B. Shop Drawings: Include dimensioned plan and elevation views of each individual component. Show equipment assemblies, method of field assembly, workspace requirements, and access for cable connections.
  - 1. Wiring diagrams. Show typical wiring schematics including the following:
    - a. Workstation outlets, jacks, and jack assemblies.
    - b. Patch cords.
    - c. Patch panels.
- C. Cable Administration Drawings: As specified in Part 3.
- D. Product Certificates: For each type of cable, connector, and terminal equipment, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For voice and data communication cabling to include in emergency, operation, and maintenance manuals.

#### 2.11 QUALITY ASSURANCE

- A. Association in paragraph below is an industry trade association. See Editing Instruction No. 2 in the Evaluations.
- B. Installer Qualifications: System installer must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.
- C. Retain first paragraph and subparagraph below if Contractor selects testing agency. 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.

- D. Source Limitations: Obtain all products except twisted-pair and fiber-optic cables through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with NFPA 70.

## 2.11 COORDINATION

- A. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute to other participants.
  - 3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

## 2.11 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Patch-Panel Units: One of each type for every six installed, but no fewer than one.
  - 2. Connecting Blocks: One of each type for every 25 installed, but no fewer than one.
  - 3. Outlet Assemblies: One of each type for every 25 installed, but no fewer than one.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cable:
    - a. Commscope.
    - b. Belden Inc.; Electronics Division.
    - c. General Cable Corporation.
    - d. Berk-tek, a Nexans Company.
    - e. Optical Cable Corporation.
    - f. Panduit Corp.
    - g. Superior Essex; Superior Telecommunications Inc.
  - 2. Terminal and Connector Components and Distribution Racks:
    - a. Commscope.
    - b. Hubbell Premise Wiring.
    - c. Leviton Telecom.
    - d. Panduit Corp.
    - e. Middle Atlantic Products, Inc.

## 2.2 SYSTEM REQUIREMENTS

- B. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- C. Expansion Capability: Unless otherwise indicated, provide spare fibers and conductor pairs in cables, positions in cross-connect and patch panels, and terminal strips to accommodate 20 percent future increase in active workstations.

## 2.3 PATHWAYS

- D. General Requirements: Comply with TIA/EIA-569-D.
- E. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.
  - 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
  - 2. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 3. Lacing bars, spools, J-hooks, and D-rings.
  - 4. Straps and other devices.
- F. Conduit and Boxes: Comply with requirements in Division 16 Section "Raceway and Boxes." Flexible metal conduit shall not be used.

## 2.4 BACKBOARDS

- G. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

## 2.5 EQUIPMENT FRAMES

- H. General Frame Requirements:
  - 1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
  - 2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
  - 3. Finish: Manufacturer's standard, baked-polyester powder coat.
- I. Floor-Mounted Racks: Modular-type, steel or aluminum construction.
  - 1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
  - 2. Baked-polyester powder coat finish.
- J. Cable Management for Equipment Frames:
  - 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.
  - 5. Provide 2U horizontal wire manager for each 48 port patch panel.

## 2.6 CATEGORY 6A TWISTED-PAIR CABLES

- A. Description: Four-pair, balanced-twisted pair cable, color-coded; enclosed in PVC jacket with internal spline, certified to meet transmission characteristics of Category 6A cable at frequencies up to 500MHz
- B. Standard: Listed as complying with TIA-568-C.2 for Category 6a cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP)
- E. Cable Rating: Plenum
- F. Cable Jacket Color : Blue
- G. 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.

## 2.7 TWISTED-PAIR CABLES CONNECTORS AND TERMINAL EQUIPMENT

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. Comply with the performance requirements of Category 6A.
- C. Comply with TIA/EIA-568-C.2, IDC type, using modules designed for punch-down caps or tools.
  - 1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
  - 2. IDC Connecting Hardware: Consistent throughout Project.
- D. Cable shall be terminated with connecting hardware of same category or higher.
- E. Source limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- F. Cross-Connect Panel: Modular array of IDC terminal blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
  - 2. Mounting: Backboard.
- G. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
  - 2. Mounting: Rack.
- H. Jacks and Jack Assemblies for UTP Cable: Modular, listed as complying with Category 6, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service.
- I. UTP Patch Cords: Four-pair cables in 48-inch lengths, terminated with RJ-45 plug at each end. Use keyed plugs for data service. Provide one for each terminated jack.

J. Workstation Outlets:

1. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.2.
2. Faceplate: High-impact plastic; color as selected by Architect.
3. Mounting: Flush, unless otherwise indicated.
4. Marked to indicate transmission performance.

2.8 VOICE AND DATA OUTLETS

- A. Workstation Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, modular, RJ-45. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Dual jack-connector assemblies mounted in single or multigang faceplate.
1. Faceplate: High-impact plastic; color as selected by Architect.
  2. Mounting: Flush, unless otherwise indicated.
  3. Legend: Factory-labeled, top jack "Voice" and bottom jack "Data," by silk-screening or engraving.
  4. Legend: Machine-printed, adhesive tape label identifying the circuit.

2.9 GROUNDING AND BONDING

- A. Materials: Comply with NFPA 70, TIA/EIA-607, and UL 467.
- B. Comply with requirements in Division 16 Section "Grounding and Bonding" for grounding conductors and connectors.

2.10 IDENTIFICATION PRODUCTS

- C. Comply with Division 16 Section "Electrical Identification" and the following:
1. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
- D. Comply with TIA/EIA-606-B.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION OF MEDIA

- A. Horizontal Cable for Data Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.
- B. Horizontal Cable for Voice Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

- C. Backbone Cable for Voice/Data Service: Use multi-mode mode fiber-optic cable for runs between equipment rooms and wiring closets and for runs between wiring closets.

### 3.3 INSTALLATION

- A. Wiring Method: Install wiring and optical fiber in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
- B. Install cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
- C. Install cables without damaging conductors, shield, or jacket.
- D. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
- E. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  - 1. Pull cables simultaneously if more than one is being installed in same raceway.
  - 2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
  - 3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
- F. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
- G. 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.
- H. Wiring within Wiring Closets and Enclosures: Provide conductors of adequate length. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- I. Separation of Wires: Comply with TIA/EIA-569-D rules for separating unshielded copper voice and data communication cabling from potential EMI sources, including electrical power lines and equipment.
- J. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- K. Use splice and tap connectors compatible with media types.

### 3.4 GROUNDING

- A. Comply with Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. Signal Ground Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
- D. Signal Ground Bus: Mount on wall of main equipment room with standoff insulators.



- E. Signal Ground Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

### 3.5 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

- A. Install plywood backboards on walls of equipment rooms and wiring closets from floor to ceiling.
- B. Mount patch panels, terminal strips, and other connecting hardware on backboards, unless otherwise indicated.
- C. Group connecting hardware for cables into separate logical fields.
- D. Use patch panels to terminate cables entering the space, unless otherwise indicated.

### 3.6 INSTALLATION STANDARDS

- A. Comply with requirements in TIA/EIA-568-C.0, TIA/EIA-568-C.1, TIA/EIA-568-C.2 and TIA/EIA-568-C.3.

### 3.7 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in Division 16 Section "Electrical Identification" and TIA/EIA-606A.
- B. System: Coordinate with Owner to match existing identification system in use in buildings for cable identification.
- C. Workstation: Label cables within outlet boxes.
- D. Distribution Racks and Frames: Label each unit and field within that unit.
- E. 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. Cables, General: 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.
- G. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
- H. Cable Schedule: Post in 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, in software and format selected by Owner.
- I. Cable Administration Drawings: Show building floor plans with cable 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. Follow convention of TIA/EIA-606.

### 3.8 FIELD QUALITY CONTROL

- A. Perform test and inspections
- B. Tests and Inspections
  - 1. Visually inspect UTP and optical fiber cable 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/EIA-568-C.1.
2. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.
  3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  4. Test UTP 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 but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-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.
5. Optical Fiber Cable Tests:
- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-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 1 direction according to TIA/EIA-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 that calculated according to equation in TIA/EIA-568-C.1.
6. UTP Performance Tests:
- a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-C.1 and TIA/EIA-568-C.2:
    - 1) Wire map.
    - 2) Length (physical vs. electrical, and length requirements).
    - 3) Insertion loss.
    - 4) Near-end crosstalk (NEXT) loss.
    - 5) Power sum near-end crosstalk (PSNEXT) loss.
    - 6) Equal-level far-end crosstalk (ELFEXT).
    - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
    - 8) Return loss.
    - 9) Propagation delay.
    - 10) Delay skew.

7. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
  - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
  - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- C. Document data for each measurement. 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. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 26 7150

## SECTION 284621 - FIRE ALARM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes extending the existing fire alarm systems with detectors, signal equipment, controls, and devices, extending the existing fire alarm notification devices.
- B. The existing systems are maintained and serviced by the following:
  - 1. Fire Safety Systems. – EST3.
- C. This project consists of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm and detection operations.
  - 2. Communicate alarms and troubles to remote monitoring systems.
  - 3. Emergency Shutdown of HVAC equipment.
  - 4. Operation of smoke dampers.
- D. Compatibility with existing equipment: The new Fire Alarm System components shall operate as an extension of the existing systems installed in the building.
- E. All extensions shall be fully compatible and UL Listed as a complete system.
- F. Related Sections include the following:
  - 1. Division 08 Section "Door Hardware" for door closers/holders/smoke detectors, electric door locks, and release devices that interface with fire alarm systems.

#### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

#### 1.4 SYSTEM DESCRIPTION

- A. General: Extend and upgrade the existing fire alarm systems. Provide a complete and satisfactorily operating fire alarm system as described herein, using material and equipment of manufacturer, type, size, rating and performance to match existing (Noncoded, addressable system with manual and automatic alarm initiation; multiplexed signal transmission dedicated to fire alarm service only.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
  - 2. Battery: Sizing calculations.
  - 3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
- C. Coordination Drawings: Plans, sections, and elevations drawn to scale and coordinating installation of smoke detectors in ducts and access to them. Show the following near each duct smoke provision of detector installation:
  - 1. Size and location of ducts, including lining.
  - 2. Size and location of piping.
  - 3. Size and arrangement of structural elements.
  - 4. Size and location of duct smoke detector, including air-sampling elements.
- D. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
- F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.
- G. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 01. Comply with NFPA 72.
- H. Certificate of Completion: Comply with NFPA 72.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.

- D. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
- E. Comply with NFPA 72.

#### 1.7 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of existing Fire Alarm Service: Do not interrupt fire alarm service to facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated.
  - 1. Notify Architect and Owner no fewer than seven (7) days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of Fire Alarm service without Owner's written permission.
- C. Use of devices during construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

#### 1.8 SEQUENCING AND SCHEDULE

- A. Existing Fire Alarm Equipment: Existing Fire Alarm System shall remain. Provide new devices and equipment as required. Maintain existing system fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "Not In Service" until it is accepted.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by existing equipment manufacturer.
  - 1. Notifier NFS series

#### 2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.

- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground or open circuit occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.
- I. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- J. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a heat detector, operation of a sprinkler flow device, or verified automatic alarm operation of a smoke detector initiates the following:
  - 1. Notification-appliance operation.
  - 2. Identification at the FACP and the remote annunciator of the device originating the alarm.
  - 3. Transmission of an alarm signal to the remote alarm receiving station.
  - 4. Unlocking of electric door locks in designated egress paths.
  - 5. Release of fire and smoke doors held open by magnetic door holders.
  - 6. Recall of elevators.
  - 7. Shutdown of fans and other air-handling equipment serving zone when alarm was initiated.
  - 8. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
  - 9. Recording of the event in the system memory.
- K. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
  - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- L. Smoke detection for zones or detectors with alarm verification initiates the following:
  - 1. Audible and visible indication of an "alarm verification" signal at the FACP.
  - 2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
  - 3. General alarm if the alarm is verified.
  - 4. Cancellation of the FACP indication and system reset if the alarm is not verified.
- M. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status

and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory.

- N. Removal of an alarm-initiating device or a notification appliance initiates the following:
  - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
  - 2. Transmission of trouble signal to remote alarm receiving station.
- O. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

## 2.3 SMOKE DETECTORS

- A. General: Include the following features:
  - 1. Operating Voltage: 24-V dc, nominal.
  - 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 3. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
  - 4. Sensitivity: Can be tested and adjusted in-place after installation.
  - 5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
  - 6. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with twist-locking plug connection.
  - 7. Match existing devices.
- B. Analog Addressable Photoelectric Smoke Detectors: Include the following features:
  - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  - 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
  - 3. Standard addressable base.
  - 4. Match existing devices.
- C. Analog Addressable Heat Detectors: Include the following features:
  - 1. Provide rate compensated, fixed temperature sensing, selectable with or without rate-of-rise temperature sensing. Rate –of-rise selectable for either 15 degree F or 20 degree F per minute. Fixed temperature of 135 degree F or 155 degree F. Standard addressable base.
  - 2. Match existing devices.
- D. Duct Smoke Detector: Photo-Electric type.
  - 1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
  - 2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
  - 3. Remote Test Station: Key switch test switch and power indicator.



## 2.4 CARBON MONOXIDE DETECTORS

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.
  - 1. Mounting: Adapter plate for outlet box mounting.
  - 2. Testable by introducing test carbon monoxide into the sensing cell.
  - 3. Detector shall contain a 24VDC local sounder base, and shall initiate a supervisory signal at the FACP.
  - 4. Detector shall provide alarm contacts and trouble contacts.
  - 5. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
  - 6. Comply with UL 2075.
  - 7. Locate, mount, and wire according to manufacturer's written instructions.
  - 8. Provide means for addressable connection to fire-alarm system.
  - 9. Test button simulates an alarm condition.

## 2.5 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
  - 2. Provide synchronized and field selectable multi-candela devices.
- B. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch-high letters on the lens.
  - 3. Rated Light Output: min. 110 candela or as values indicated on plans.
  - 4. Provide synchronized and field selectable multi-candela devices.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet from the horn.
- D. Notification Appliance Power Panel (NAC): Provide power panel with four (4) 2 Amp supervised signaling circuits. Panel power requires 120V. Provide quantity of power panels as required.

## 2.6 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

- A. Description: LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

## 2.7 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

- A. 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 interface device
    - 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.

### PART 3 - EXECUTION

#### 3.1 EQUIPMENT INSTALLATION

- A. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.
- B. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.
- C. Smoke Detectors near Air Registers: Install no closer than 60 inches
- D. Duct Smoke Detectors: Comply with manufacturer's written instructions.
  1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  2. Install sampling tubes so they extend the full width of the duct.
- E. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- E. 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 the receipt or transmission of signal from other floors or zones.
- F. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section 260050 "Basic Electrical Materials and Methods."
- B. Install instructions frame in a location visible from the FACP.

### 3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
- C. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and

other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
  - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
  - 2. Test all conductors for short circuits using an insulation-testing device.
  - 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
  - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
  - 5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
  - 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
  - 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

### 3.6 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 8 hours' training.
  - 2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
  - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

### 3.8 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to three requested visits to Project site for this purpose.

END OF SECTION 284621

## SECTION 311201 - SITE PREPARATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in Division 31, 32 and 33.

#### 1.2 DESCRIPTION OF WORK

- A. The extent of site preparation is shown on the drawings.
- B. Site preparation work includes, but is not limited to, the following:
  - 1. Site investigation and underground utility identification (GPR)
  - 2. Vacuum Excavation (utility locating)
  - 3. Protection of existing trees, shrubs, ground covers and lawns to remain
  - 4. Topsoil stripping and stockpiling on site (See Section 329201)
  - 5. Site clearing and removals
  - 6. Asphalt milling
  - 7. Saw cutting
  - 8. Relocations/salvaged materials
  - 9. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 329201 – Sodded Lawns
- C. Section 334001 - Storm Drainage

#### 1.4 SITE INVESTIGATION

- A. The Contractor shall visit the site before bidding, inform and familiarize themselves of all site conditions, including but not limited to, site topsoil, sub-soil, rock, subsurface and groundwater conditions affecting proposed work. No allowance or additional cost will be made in the work of this contract for failing to determine overall project site conditions.
- B. Verify locations and protect utilities and structures, whether or not shown on the drawings. Existing utilities and structures shown on the drawings are for the Contractor's convenience and locations are not guaranteed.

- C. Verify survey information given on drawings. Walk the site with the Owner's Representative to discuss approximate locations of reputed utilities shown and not shown on the survey, prior to performing work. The Contractor shall provide and perform Ground Penetrating Radar (GPR) utility location within an area of approximately **140,000 sf**, as directed by the Architect and Owner, prior to performing any excavation. Notify the Architect and Owner of any and all discrepancies prior to ordering materials and commencing any work. Commencement of any work will be construed as complete acceptance of survey information.
- D. Provide Vacuum Excavation (SoftDig or similar) utility locating holes in **TEN (10)** locations onsite in areas as directed by the Architect and Owner.
- E. Contractor shall provide Test Pits at all connection points at existing utilities and at all utility crossings to verify utility locations, size, type, invert, and elevations **PRIOR** to ordering and taking delivery of materials for construction. Notify the Architect and Owner of finding immediately. Contractor shall furnish all labor and materials to accomplish at no additional cost to the Owner.
- F. Locate and protect from disturbance existing survey monuments, pins, markers, and benchmarks whether or not shown on drawings. When any disturbance or damage occurs, notify Architect in writing within 24 hours. Describe nature of disturbance or damage and date first occurred. Provide copies to applicable government and municipal agencies. Pay costs for restoring monuments to satisfaction of said agencies, at no additional expense to the Owner.
- G. Contractor to model, coordinate, and verify all survey control points. If necessary, provide new or additional survey control points to synchronize any site model with real world coordinates at no additional cost to the Owner.

## 1.5 JOB CONDITIONS

- A. The terms "Architect" and "Landscape Architect" for Divisions 31, 32 and 33 work shall mean Appel Osborne Landscape Architecture, 102 West Division St., Suite 100, Syracuse, NY 13204, Tel. (315) 476-1022; or other representative(s) that Young + Wright Architectural may determine.
- B. Examine site drawings and specifications for the entire project. Become familiar with the scope and sequencing of work required. Coordinate and cooperate with other Contractors and trades working in and adjacent to the project.
- C. Examine work prepared prior to this contract. Commencement of work will be construed as complete acceptance of all preparatory work by others.
- D. Obtain and pay for permits required by authorities. Perform the work in compliance with applicable standards, codes and requirements of governing authorities having jurisdiction.
- E. Safety is the sole responsibility of the Contractor.
- F. Burning on site and use of explosives are not permitted.

- G. Responsibility for existing utilities:
1. Contact Dig Safely New York at least two (2) full working days, and not more than ten (10) working days, before digging begins or as required by latest state law. Locate by hand excavation and provide protection from damage to existing utilities to remain in the area. (Tel. 811)
  2. Existing utilities encountered within excavated areas shall be supported, blocked and/or braced in a manner approved by the owner of the utility. Leave supports in place to the extent required by the owner of the utility.
  3. Should uncharted or incorrectly charted utilities be encountered, notify the Architect immediately for directions as to procedure.
  4. Do not break utility connections without providing temporary services as acceptable to the Architect and the owner of the utility.
  5. Repair and pay for damages to existing utilities as directed by utility Owner at no additional cost to the Owner.
  6. Cap ends of utilities to be abandoned or removed in accordance with regulatory agencies and as directed by the Architect.
- H. Provide protections and conduct operations to prevent injury and damage to persons, work of other Contractors, existing items to remain, structures, pavements, lawns, and adjacent properties.
- I. Restore work damaged by this Contractor inside and outside the contract limits to the condition existing prior to the start of work, unless otherwise directed, to the satisfaction of the Architect at no additional cost to the Owner.
- J. Vehicular and pedestrian traffic control:
1. Maintain vehicular and pedestrian traffic during construction activities.
  2. Provide alternate routes and traffic control around closed and obstructed traffic ways as required by governing regulations or the Owner.
  3. Provide temporary fencing, flagpersons, barricades, warning signs, and warning lights or other measures to protect the public and cause the least interruption of work.
- K. Field Measurements: Take necessary field horizontal and vertical measurements required in order to perform the work and design intent shown on the drawings, and outlined in the specifications. Assume complete responsibility for accuracy of such measurements and dimensions.
- L. Removal of spoils, dust control, debris, snow and clean up:
1. Control air pollution caused by dust and dirt; comply with governing regulations. Water to control dust when necessary and as directed by the Architect or Certified Erosion Control Specialist. Provide water sprinkling materials, equipment and labor to prevent the nuisance of dust to the surrounding areas.
  2. Legally dispose of removed and demolished items, including trash and debris, off the Owner's property, at a licensed disposal facility having adequate capacity to accept the project's waste.
  3. Burning of combustible materials on the site is not permitted.



4. During the contract and at intervals as directed by the Architect, clear the site of extraneous materials, rubbish, construction waste, and debris. Leave the site in a clean, safe, neat, well-draining condition.
  5. Soil and Snow Removal: Sweep roads, access ways, paved areas, and parking areas where soil, mud and debris have dropped or tracked from construction and delivery vehicles on a daily basis and as directed by the Architect or Certified Erosion Control Specialist. Remove snow and ice from roads, access ways, paved areas and parking areas utilized for site construction purposes.
  6. Spoils: Remove from site and dispose when not required for fill or determined to be unsatisfactory soil material per Section 312201 - Site Earthwork.
- M. Construction Review - General: Site visits will be made by the Architect to observe construction conformance to drawings and specifications. The occasional site visits by the Architect shall not be construed as supervision of construction or make them responsible for the safety programs and precautions, including but not limited to: the safe access, visit, use, work travel, or occupancy of any person. Site visits shall not make the Architect responsible for means, methods, techniques, sequences or procedures of construction selected by the Construction Manager, Contractor or his Sub-contractors.
- N. Site Complexity: The existing site will be intensively developed. Because of the construction and resulting graphic complexity, it is impractical to show every detail. However, the general design intent is clearly shown and shall be applied to individual conditions not specifically shown as directed by the Architect and at no additional cost to the Owner.
- O. Asbestos, Toxic and Hazardous Materials: The Division 31, 32 and 33 site work contract does not include testing for, handling or removal of hazardous materials such as, but not limited to: asbestos, fuel, oil, PCB's, or other toxic or hazardous waste materials as identified by the EPA and/or NYSDEC. If any such materials are encountered during any part of the site work, the Contractor is responsible for identifying potential hazardous material and immediately notify all governing agencies having jurisdiction as required by law. Also, within one (1) hour of discovery notify the Architect, Landscape Architect, Consultants, and Owner. The Owner shall provide testing and removal by others, under separate contract. The Contractor shall recommence work under this contract when the Owner provides written certification that remediation is complete per governing agency. The Contractor shall not be penalized for any delays caused by the hazardous testing and removal, unless such hazardous material incident was a result of Contractor's operations. The Contractor shall indemnify and hold harmless the Architect, Landscape Architect, Consultants and Owner, agents, and employees from and against all claims, damages, losses and expenses, direct and indirect or consequential damages, including but not limited to fees and charges of attorneys and court and arbitration costs, arising out of or resulting from the performance of the work by the Architect, Landscape Architect, Consultants and Owner, or claims against the Architect, Landscape Architect, Consultants and Owner arising from the work of others, related to hazardous waste.

The above indemnification provision extends to claims against the Architect, Landscape Architect, Consultants and Owner which arise out of, are related to, or are based upon, the dispersal, discharge, escape, release or saturation of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, or pollutant in or into the atmosphere, or on, onto, upon, in

or into the surface or subsurface soil, water or water courses, objects, or any tangible or intangible matter, whether sudden or not.

Should the hazardous material incident be the result of the Contractor's operations, the Contractor shall be responsible for all costs associated with the discovery and remediation of such hazardous material such as, but not limited to: testing, consultant fees, damage, loss, fees and charges of attorneys, court and arbitration costs, claims by other contractors, direct and indirect or consequential damages.

- P. Salvageable Items: Remove at any time after work starts. Storage or sale on site of salvageable and removed items is not permitted. Do not remove topsoil from site without written permission from the Owner.

## 1.6 SUBMITTALS

- A. Provide photographic documentation. Photographically document existing features which, may be affected by the construction, inside and outside the contract limit line. Existing features include, but are not limited to: structures, pavements, curbs, utilities, lawns and vegetation, especially individual trees which are over six (6") inches in diameter and noted to remain on the drawings. Also, particular attention shall be paid to the construction access, stockpile and haul road areas. Distribute a copy of the photographic documentation (digital format) to the Owner and Architect prior to the start of construction.
- B. Ground Penetrating Radar (GPR) Mapping and Report.
- C. Vacuum Excavation Report with pictures, elevations, and descriptions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC FENCE

- A. Shall be new or good quality used 4'-0" high heavy duty orange plastic fence NC450.
- B. Posts shall be new or good quality U-channel posts to hold plastic fence.

### 2.2 OTHER PROTECTIVE DEVICES

- A. Shall include, but not be limited to; wood planks, rubber mats, barriers, lights, barricades, coverings, traffic controls, steel plates, and other temporary protections.
- B. Contractor to provide all necessary protections required by Occupational Safety and Health Administration (OSHA).

## PART 3 - EXECUTION

### 3.1 PROTECT EXISTING VEGETATION TO REMAIN

- A. Prior to commencing site preparation work, notify Architect, and meet on site to locate existing trees, lawns and vegetation which are to remain.
- B. Protect and keep existing vegetation to remain free from physical damage. Keep in a healthy, vigorous growing condition for the entire construction period as follows:
  - 1. Keep site disturbance and staging limits to a minimum. Obtain approval from Owner for material and equipment storage areas. Limit access points and routes to the project site. Coordinate site access with other trades and contractors on the work site.
  - 2. Groups of Trees and Vegetation: Place orange plastic construction fencing around drip line(s) of trees and plant beds as detailed or directed by the Architect. Do not store materials, run equipment, park vehicles, or otherwise disturb area within the drip line (full canopy of tree) or in plant beds.
  - 3. Specimen and Individual Trees: Protect each as noted and detailed. Do not store materials, run equipment, park vehicles or otherwise disturb area within the drip line (full canopy of tree).
- C. Rejuvenate damaged vegetation by pruning watering, fertilizing, staking and other methods as directed by the Architect. Replace trees and other vegetation that cannot be restored to full growth with comparable size, quantity, quality and species as determined by the Architect.
- D. Repair lawns disturbed due to construction operations outside the grading limits, as specified and directed by the Architect. Provide screened topsoil, seed, and mulch over damaged lawn areas, access ways or where tire rutting occurred.

### 3.2 TOPSOIL STRIPPING AND STOCKPILING ON SITE

- A. Strip full depth of existing topsoil from areas to be regraded, paved, or otherwise built upon. When amount of available topsoil exceeds what is indicated in geo-tech/boring report, on site test pits, or Contractor assumed depth, continue to remove all topsoil and lower the paved or built element subgrade. Place additional satisfactory earth fill in uniform depths as indicated in the Site Earthwork Section 312201. Maintain finished grades as shown on the drawings. This work shall be done at no additional cost to the Owner.
- B. Minimum quantity of topsoil shall be as needed to provide four (4") inches settled depth on lawn areas. Verify quality and quantity. Supply imported topsoil when amount of available topsoil meeting above requirements is less than what is required for the proposed lawn areas. See Section 329201 for imported topsoil requirements.
- C. When amount of available topsoil meeting above requirements exceeds what is required for the proposed lawn areas, lower the lawn subgrade and place additional topsoil in a uniform depth as directed by the Architect. Maintain finish grades as shown on the drawings. This work shall be performed and supplied at no additional cost to the Owner.

- D. Topsoil shall be well drained, homogeneous texture soil of uniform grade, without the admixture of subsoil material. Topsoil shall be free of dense material, hardpan, and stone over three-quarters (3/4") inch in diameter, and other objectionable foreign material including, but not limited to, brick, concrete, asphalt, glass, nails, screws, toxins, hazardous wastes and chemicals (such as, but not limited to, atrizene and muriatic acid) that may be injurious to humans, animals and plant materials.
- E. Excess topsoil, not needed for proposed lawns, as specified, shall be loaded and hauled offsite at no additional cost to the Owner. Should existing topsoil onsite not be in sufficient quantities to provide for proposed lawns and planting area depths as indicated on the plans and as specified, contractor shall furnish and install the required amount of topsoil at no additional cost to the Owner.

### 3.3 SITE CLEARING AND REMOVALS

- A. Items and materials noted to be removed shall become the property of the Contractor, unless otherwise noted. Obtain Owner's approval prior to removal off site or for relocation of salvaged material on site. Remove material off site and legally dispose of it. Backfill voids with imported granular backfill, placed in eight (8") inch layers compacted to 95% maximum density.
- B. Remove physical elements above and below grade as shown and which interfere with proposed construction. Physical elements include but are not limited to: trees, root systems, shrubs, vines, grass, vegetation, pavements, walks, curbs, gutters, foundations, previous construction materials, glass, headwalls, flared end sections, catch basins, manholes, inlets, drywells, septic tanks, unused utilities, pipes, cisterns, walls, rocks, and other debris.
- C. Trees, shrubs and roots shall be completely removed and disposed of legally off site.
- D. Maintain existing utilities shown to remain and protect from damage during demolition and construction operations. Do not interrupt existing utilities; provide temporary services when required, as acceptable to the Architect.
- E. Research with Owner possible locations of existing subsurface utilities prior to excavating.

### 3.4 ASPHALT MILLING

- A. The Contractor has the option to mill existing asphalt and dispose off site, Or;
- B. Mill existing asphalt and use as partial stone subbase (for new pavements) when it meets gradation noted in 312201 for maximum 50% of the stone subbase specified depth. Provide a mechanical analysis based on ASTM C 136 for approval prior to installation.
- C. The Contractor shall use equipment with automatic grade and slope controls, capable of cold milling existing asphalt pavement to an accurate depth of cut, profile and cross slope and shall be capable of loading the milled material directly into trucks.

- D. Cold milling asphalt pavement shall be performed in a manner which prevents the tearing and breaking of underlying and adjacent pavement and the contamination of the millings with granular subbase material, subgrade or deleterious materials. All millings shall be loaded directly to trucks from the milling machine and hauled to stockpile or disposed of.
- E. The milled surface shall be swept and jet washed clean prior to installation of new surface material. The Contractor shall sweep the surface in a manner which minimizes dust.
- F. The Contractor shall promptly repair any and all localized areas of distress in the milled surface that may present a hazard to traffic, the finished surface, the stability of the new asphalt, or deemed unsuitable by the Architect, at no additional cost to the Owner.
- G. Contractor shall apply NYSDOT approved tack coat to the cleaned, milled surface in preparation to received new top course asphalt as specified in Section 321201 - Asphalt Paving.

### 3.5 SAW CUTTING

- A. The Work consists of vertical saw cutting of the existing asphalt or concrete pavement structure to facilitate the removal of the asphalt or concrete bound material.
- B. The equipment shall be capable of producing a smooth vertical saw cut without causing damage to the adjacent pavements or related site features.
- C. The Contractor shall saw cut the asphalt/concrete pavement to a depth which will allow removal of the material without causing damage to the adjacent pavement. Rough, jagged or cracked edges will not be acceptable. Concrete pavement shall be removed at the nearest contraction joint.

### 3.6 RELOCATIONS

- A. Any item noted to be relocated shall be removed by the Contractor from its existing position without damaging it, stored, protected from theft, fire, vandalism and damage for the project duration. Reset in the location(s) and in the manner detailed, noted on the drawings or specified.
- B. Backfill voids with imported granular fill material, placed in eight (8") inch layers compacted to 95% maximum density when located in proposed pavement areas or 90% maximum density when located in proposed non-paved areas.
- C. Salvaged items shall be returned to the Owner as noted on the drawings. Move items to Owner designated areas.

### 3.7 CLEAN UP

During the contract and at intervals as directed by the Architect and as site preparation is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 311201

## 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. Preparing subgrades for slabs-on-grade.
2. Excavating and backfilling for buildings and structures.
3. Subbase course for concrete slabs-on-grade.
4. Excavating and backfilling structures.

#### B. Related Sections:

1. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
2. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.

### 1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."
- B. Quantity allowances for earth moving are included in Division 01 Section "Allowances."

### 1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. 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 special inspector and/or geotechnical engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by special inspector and/or geotechnical engineer. Unauthorized excavation, as well as remedial work directed by engineer, shall be without additional compensation.
- E. Structures: Buildings, footings, foundations, retaining walls, slabs, or other man-made stationary features constructed above or below the ground surface.
- F. Subbase Stone Course: Aggregate layer supporting the slab-on-grade.
- G. Subgrade: Uppermost surface of an excavation immediately below subbase, or suitable granular fill materials.
- H. Suitable Granular Fill: Soil materials used to raise existing grades beneath slabs-on-grade.
- I. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.5 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  1. Geotextiles.
  2. Controlled low-strength material, including design mixture.
- B. Samples for Verification: For the following products, in sizes indicated below:
  1. Geotextile: 12 by 12 inches.
- C. Qualification Data: For qualified testing agency.
- D. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  1. Classification according to ASTM D 2487.
  2. Laboratory compaction curve according to ASTM D 1557.
- E. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

## 1.6 QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site.

## 1.7 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service or "Call Before You Dig" for area where Project is located before beginning earth moving operations.



## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Suitable Granular Fill / Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, 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.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, 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 Stone: Crusher run stone, which is free of clay, organics and friable or deleterious particles meeting the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12, Type 2 Subbase.
- E. Structural Fill: Same material as subbase stone.

### 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. Grab Tensile Strength: 247 lbf; ASTM D 4632.
  - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
  - 4. Tear Strength: 90 lbf; ASTM D 4533.
  - 5. Puncture Strength: 90 lbf; ASTM D 4833.
  - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
  - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

### 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
  - 1. Portland Cement: ASTM C 150, Type I or Type II.
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
  - 4. Water: ASTM C 94/C 94M.

5. Air-Entraining Admixture: ASTM C 260.

- B. Produce conventional-weight, controlled low-strength material with compressive strengths of 80-psi to 100 psi under slab-on-grade and 250-psi under footing and foundations when tested according to ASTM C 495.

## 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.

## 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. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. 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.

### 3.3 EXCAVATION, GENERAL

- A. 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; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

### 3.4 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.

### 3.5 SUBGRADE INSPECTION

- A. Notify special inspector and/or geotechnical engineer when excavations have reached required subgrade.
- B. If special inspector and/or geotechnical engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted structural fill or controlled low strength 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 7 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, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by special inspector and/or geotechnical engineer, and replace with compacted structural 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 special inspector and/or geotechnical engineer, without additional compensation.

### 3.6 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 3000 psi, may be used when approved by engineer.

### 3.7 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.

### 3.8 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 and 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.

### 3.9 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 steps and ramps, use suitable granular fill to raise grades, then subbase stone of thickness indicated on drawings.
  - 2. Under building slabs, use suitable granular fill to raise grades, then subbase stone of thickness indicated on drawings.
  - 3. Under footings and foundations, use structural fill.
- C. Place soil fills on subgrades free of mud, frost, snow, or ice.

### 3.10 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.

### 3.11 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 D 1557:
  1. Under structures, building slabs, steps, and ramps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.

### 3.12 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. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.13 SUBBASE STONE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place subbase stone course on subgrades or suitable granular fill, if required, free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact subbase stone course under cast-in-place concrete slabs-on-grade as follows:
  1. Install separation geotextile on prepared subgrade or suitable granular fill, if required, according to manufacturer's written instructions, overlapping sides and ends.
  2. Place subbase stone course 6 inches or less in compacted thickness in a single layer.
  3. Place subbase stone 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 subbase stone course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.14 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 and maximum lift thickness comply with requirements.
  3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.
  4. See statement of special inspections for additional testing and inspections.
- 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 D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of 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.
- 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.

### 3.15 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.

### 3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. 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 31 2000

## SECTION 312201 - SITE EARTHWORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of site earthwork and site grading is shown on the drawings.
- B. Site earthwork includes, but is not limited to, the following:
  - 1. Fill Materials
  - 2. Source Quality Control
  - 3. Shoring, Bracing and Supporting
  - 4. Horizontal and Vertical Layout
  - 5. Grading and Excavation
  - 6. Compacted Backfill and Fill
  - 7. Field Quality Control Testing and Inspection Services
  - 8. As-Built Survey
  - 9. Guarantee
  - 10. Clean Up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 023200 - Subsurface Investigation Information
- B. Section 311201 - Site Preparation
- C. Section 312501 - Erosion, Sediment and Pollution Control
- D. Section 334001 - Storm Drainage

#### 1.3 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D 75 - Practice for Sampling Aggregates
- D. ASTM D 422 - Particle-Size Analysis of Soils (without Hydrometer Analysis)



- E. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)
- F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>)
- G. ASTM D 2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)
- H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
- K. ASTM D 6938 - In Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
- L. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- M. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
- N. Occupational Health and Safety Administration Regulations and Standards
- O. Deep Ripping and Decompaction shall be per NYSDEC recommendations, latest edition
- P. American Sports Builders Association (ASBA): Sports Fields - A Construction and Maintenance Manual, latest edition.
- Q. ASTM F2898-11 – Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-Confined Area Flood Test Method
- R. EN 12616 – Permeability of Synthetic Turf Sports Field Base Stone by Double Ring Infiltrometer, Method A.

#### 1.4 SUBMITTALS

- A. Furnish name of experienced layout foreman meeting experience requirements in 1.5 "Quality Assurance" to perform layout and obtain Architect's approval prior to performing work.
- B. Submit written report on Contractor's letterhead verifying the layout foreman's involvement with the project layout. The report shall briefly state the scope of services performed for the project, the dates work was accomplished, and an explanation of any

adjustments required, specifically listing as-built and FIELD VERIFY requirements as noted in 3.2 of this specification section.

- C. Provide Earthwork Contractor's experience requirements as indicated in 1.5, "Quality Assurance". Obtain Architect's approval prior to performing work.
- D. Samples: 10 lb. samples of each type of fill; submit in airtight containers to testing laboratory.
- E. Materials Sources: Submit name of imported materials source for each type of fill material.
- F. Fill Composition Test Reports (Imported and Onsite): Provide results of laboratory tests (less than 2 months old) on proposed and actual materials used to determine acceptability. This shall include:
  - 1. One optimum moisture-maximum density curve (Modified Proctor) for each soil/imported fill type as determined by ASTM D1557, Method A, latest issue.
  - 2. Sieve Analysis - ASTM D422
  - 3. Moisture Density Relationship - ASTM D1557, Method C / ASTM D698
  - 4. Plasticity Index - ASTM D4318
  - 5. Soundness Test - ASTM C88
  - 6. Soil Classification - AASHTO and ASTM D2487
- G. Compaction Density Test Report(s) required in Field Quality Control of this specification.
- H. Contractor's NYS Licensed Professional Engineer's layout and design calculations of sheet piling and shoring required.
- I. As-Built Survey: The Contractor shall have NYS Licensed Land Surveyor provide an updated AutoCAD file .dwg site survey, version 2024, or newer, and stamped pdf electronic copies of fully completed proposed site work (including but not limited to: spot elevations, contours, drainage structures and pipes with inverts, utilities, asphalt, concrete, and all site elements) at ALL proposed site work, to a minimum of 15'-0" beyond the proposed site work into existing conditions.

## 1.5 QUALITY ASSURANCE

- A. Perform all site earthwork, site grading and excavation in compliance with requirements of governing authorities having jurisdiction, OSHA Standards, and "References" in this project specification.
- B. The Owner will employ a licensed soil testing and inspection service for Field Quality Control Testing of materials. This Contractor will coordinate day to day scheduling with the Owner's testing agency for conformance with "Field Quality Control Testing and Inspection Services" in this project specification.
- C. Earthwork Contractor Experience Requirements: Submit business name, business Owner(s) name(s), business address, telephone number, website and/or email address

signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Earthwork for this Project. Provide a list of at least four (4) Earthwork projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.

- D. Layout Foreman Experience: The Earthwork Contractor must provide a competent layout foreman skilled in this specific type of layout/earthwork project. The layout/earthwork foreman shall have a minimum of four (4) similar projects completed within the last three (3) years. Provide a list of projects layout/earthwork foremen has completed including project name, address, Owner contact information and project scope of work.

## 1.6 JOB CONDITIONS

- A. Job conditions in Section 311201 apply.
- B. Provide sufficient quantities of fill materials to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- C. When fill materials need to be stored on site, locate stockpiles where directed by Owner.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination of material types.
  - 3. Protect all stockpiles from erosion and deterioration of materials by covering with plastic sheets, tarps or as directed by the Architect.
- D. Moisten or dry, fill or backfill materials, to the proper moisture content as determined in accordance with ASTM D1557, Method C in order to obtain proper compaction as indicated.
- E. The Contractor shall familiarize him/herself with results and information contained within the Geotechnical Data & Attachment Report. These onsite soils are very sensitive to moisture and vibration. The Contractor shall take note and anticipate these soils will lose strength and mitigate in the presence of water and normal construction traffic and may turn into a "quick" condition (i.e. complete loss of shear strength and turning into a liquid-like condition). Achieving satisfactory compaction on these soils will be difficult, especially during wet conditions. This condition shall be taken into account within the Contractor's bid and schedule.

## 1.7 SUB-SURFACE SOIL INFORMATION

- A. Refer to subsurface information elsewhere in the specifications. The geo-technical data on subsurface conditions is not intended as representation warranties of the continuity of such conditions between test pits or test borings made by the Owner and included in the specification. It is expressly understood that the Owner, Architect, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn

therefrom by the Contractor. The data is made available for the convenience of the Contractor.

- B. Additional test borings and other exploratory operations may be made by the Contractor at no additional cost to the Owner, provided such operations are acceptable to the Architect and Owner. Coordinate test locations with Owner prior to starting work. Backfill immediately when completed and repair to satisfactory conditions as determined by the Architect. It is expressly understood that the Owner, Architect, Landscape Architect, and Consulting Engineers are not responsible for interpretations or conclusions drawn therefrom by the Contractor.

## 1.8 UNUSUAL SUBSURFACE CONDITIONS

- A. Notify the Architect immediately in writing via email when unusual conditions are encountered during excavation, including, but not limited to: excessive flooding, miscellaneous structures, uncharted or unlocated utilities, foundations, bed rock, toxic and hazardous materials and chemicals (such as muriatic acid and atrizene), suspected archaeological artifacts, and unsatisfactory soil materials. Request clarification from the Owner's Representative or Architect before proceeding. Refer to paragraph 3.4 of this specification.

## PART 2 -PRODUCTS

### 2.1 FILL MATERIALS

#### A. **Satisfactory General Earth Fill:**

1. To be used at least 5'-0" outside of structural elements and retaining walls.
2. Satisfactory general earth fill shall be satisfactory on-site subsoil, or hauled in off-site subsoil free of toxics, hazardous wastes and chemicals (such as, but not limited to, atrizene and muriatic acid) that may be injurious to humans, animals and plant materials. Satisfactory earth fill shall also be free of rubbish, debris, wood, masonry, metal, frost, vegetation, organics or other deleterious material, which cannot be properly compacted. Use satisfactory general earth fill that is dry and free of clay. Rocks, gravel or soil shall not be larger than 3" in any dimension/direction.
3. Satisfactory earth fill materials are also defined as those complying with the American Association of State Highway Transportation Officials (AASHTO), M-145 soil classification Groups A-1, A-2-4, A-2-5, A-3 and Unified Soil Classification System GW, GP, GM, GC, SW, SP, SM, and SC (or a combination of these group symbols) as determined by ASTM D2487.

#### B. **Imported Granular Backfill:**

1. Imported granular backfill to be used for asphalt pavement subbase, concrete subbase, storm structures, storm pipes, water pipes, sanitary manholes, sanitary pipes, other structures, and where indicated on the drawings.

2. Backfill shall be run of crusher limestone meeting the following gradation as determined by ASTM-C136:

| Standard Sieve Sizes | Percent Passing<br>By Weight |
|----------------------|------------------------------|
| 2" or 50 mm          | 100%                         |
| 3/4" or 19 mm        | 75 - 90%                     |
| 1/4" or 6.3 mm       | 25 - 60%                     |
| #40 or 0.425 mm      | 5 - 40%                      |
| #200 or 0.075 mm     | 0 - 8%                       |

3. Backfill shall be free of debris and deleterious materials. In no case shall the plasticity index exceed 5.0 or the percentage passing the 200 mesh sieve exceed 8%. The quality of the imported granular backfill shall be determined by the magnesium sulfate soundness test, if considered suspect by the Architect or Geotechnical Engineer. The maximum percent loss at four cycles by weight shall be 20.

**C. Imported Structural Fill:**

1. Imported structural fill to be used in areas of structural elements, for top eight (8") inches of design subgrade elevation for running track, field events, tennis courts, synthetic turf fields and where noted on the drawings.
2. Shall be run-of-bank or run-of-crusher gravel free from organic matter or other deleterious materials, meeting the material gradation requirements of Item 304.05 Sub-base Course, Type 4, of the NYSDOT's Standard Specifications for Construction Materials, as determined by ASTM C136.

| Standard Sieve Sizes | Percent Passing<br>By Weight |
|----------------------|------------------------------|
| 2" or 50 mm          | 100%                         |
| 1/4" or 6.3 mm       | 25 - 60%                     |
| #40 or 0.425 mm      | 5 - 40%                      |
| #200 or 0.075 mm     | 0 - 8%                       |

3. Imported structural fill shall be accepted on the basis of gradation, soundness, plasticity index and a well-defined Moisture-Density Relationship Curve. Imported structural fill to be placed within 8" of final exterior subgrade shall be subject to Soundness requirements. Soundness shall be less than 30% loss based on a four-cycle magnesium sulfate soundness test. Plasticity Index of that portion of fill material passing the No. 40 mesh sieve shall not exceed 5.0.

**D. Stormwater Management Trench (SMT) Backfill:**

1. Shall be No. 1 clean, washed, crushed stone or crushed gravel meeting the following gradation as determined by ASTM C136:

| Standard Sieve Size | Percent Passing<br>By Weight |
|---------------------|------------------------------|
|---------------------|------------------------------|

|                 |         |
|-----------------|---------|
| 1" or 25.0 mm   | 100%    |
| 1/2" or 12.5 mm | 90-100% |
| 1/4" or 6.3 mm  | 0-15%   |

- E. **Backfill for Storm water Retention Structures:** Refer to Specification Section 334001 for required stone backfill.

## 2.2 UNSATISFACTORY SOIL MATERIALS

- A. Shall be defined as soil with high percentage of decomposed rock, sand, organic matter or moisture laden clay to prevent adequate compaction. Also, soil with toxics, hazardous wastes and chemicals (such as atrazine and muriatic acid) that may be injurious to humans, animals and plant materials. Also, soil with significant quantities of rubbish, debris, wood, masonry, metal, frost or other deleterious material which, in the opinion of the Geotechnical Engineer, Owner's Representative, and Architect, cannot be properly compacted shall be classified as unsatisfactory.
- B. Unsatisfactory soil materials are defined as those described in AASHTO M-145, soil classification, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 with CBR value less than 7.0. Also Unified Soil Classification System ML, CL, OL, MH, CH, OH as determined by ASTM D2487 (or a combination of these group symbols) with CBR value less than 7.0 in addition to peat (PT) and other highly organic soils, cobbles, boulders; and soil materials, of any classifications that have a moisture content at the time of compaction beyond the range of 1% below and 3% above the optimum moisture content of the soil material/backfill material, as determined by the Moisture Density Relationship test.
- C. When unsatisfactory soil materials are encountered at proposed subgrades and other design elevations, proceed as described in Part 3 (Execution) of this Section.
- D. When excavated materials become unsatisfactory as a direct result of the Contractor's work, this shall result in the rejection of the unsatisfactory soil materials by the Architect.
- E. The use of slag (a byproduct of metal processing) or recycled/crushed concrete is unacceptable for any use on this project site.

## 2.3 SOURCE QUALITY CONTROL

- A. See "Submittals" and "Quality Assurance" of this specification section for general requirements for testing and analysis of soil and fill materials.
- B. Where fill materials are specified by reference to a specific standard, Contractor is responsible to test and analyze all samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest until approved.

## 2.4 SHORING, BRACING AND SUPPORTING

- A. Shoring and bracing shall conform to the requirements of the Occupational Health and Safety Act.
- B. Shoring and bracing shall be provided, placed and maintained at the locations and elevation that are necessary or required to: support and protect the sides and bottom of the excavation; prevent undue disturbance or weakening of the supporting materials below or beside the works; prevent movement of ground which may disturb or damage the work, adjacent pavements, property, structures or other works.
- C. Provide materials for shoring, bracing, and supporting, such as sheet piling, uprights, sheathing, stringers, and cross-braces, in good serviceable condition. Use timbers that are sound and free of large or loose knots.
- D. Provide design by Contractor's NYS Licensed Engineer, when shoring is required to perform work as shown on the drawings. Submit to Architect for approval.
- E. Installation: Shoring and bracing shall be driven and placed so that it can be removed as backfilling takes place without damage to the pipeline or its appurtenances, structures, and without settlement of or damage to adjacent pavements and structures.
- F. Removal: The Contractor shall remove all shoring and bracing as the excavation is backfilled, unless directed by the Architect to be left in place. The procedure for extracting shoring and bracing and placing backfill shall ensure the backfill load is applied gradually, and disturbance of the works or foundation material is avoided.
- G. Support all utilities as required by the municipality/utility owner.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify field conditions such as bench marks, monuments, topography, inverts, locations of utilities and property lines before proceeding. Notify the Architect immediately, in writing, of discrepancies prior to commencing work. Commencement of work will be construed as complete acceptance of survey and layout information. Additional costs resulting from failure to verify field conditions prior to commencing work shall be borne by this Contractor and at no additional cost to the Owner.

### 3.2 LAYOUT

- A. Stake layout up to and including those elevations and dimensions specifically noted on drawings as "FIELD VERIFY" (FV). Ensure that the field elevation and dimension agrees with the elevation and dimension on the drawings before continuing. Notify the Architect immediately, in writing, of any discrepancies prior to commencing work. Additional costs resulting from failure to verify dimensions as noted on drawings shall be borne by this Contractor and at no additional cost to the Owner.

1. Assume sole responsibility for the accuracy of the layout work.
2. Run from point(s) of beginning (POB), base lines, property monuments, benchmarks, iron survey pins, or other points given on the drawings.
3. Roads, Parking Areas, and Walks: Accurately locate and stake curb lines, center line, swales, point of curve and tangency as necessary to accurately build.
4. Buildings and Site Features: Accurately locate and stake corners, offset corners, slopes, and center lines as necessary to accurately build.
5. Pipe Work: Accurately locate with laser.

### 3.3 GRADING

- A. Cut and Fill: Presume the earthwork does **NOT** balance on site. Meet the grades shown on the drawings. Haul in or haul away as may be necessary. Provide earthwork calculations and provide for imported or exported material as part of bid. No additional costs will be allowed.
- B. Grade areas as indicated, including transition areas, with uniform levels and slopes between finish elevations.
- C. Cut to grades and profiles indicated.
- D. Set grade stakes at fifty-foot (50') intervals, at corners, and breaks in grade.
- E. Conduct operations to avoid ponding of water. Provide all pumping equipment, sump pits, and temporary diversion swales where and when necessary to continue work performance on schedule and as specified.
- F. Shape subgrade surface of site elements to within 0.10' above or below required subgrade elevation, compacted as required and sloped to provide drainage as shown on the drawings. Notify Architect and Geo-Technical Engineer for subgrade review prior to continuing work.
- G. Refer to Section 311201 for topsoil requirements.

### 3.4 EXCAVATION

- A. Remove and legally dispose of material encountered to obtain required subgrade elevations, including pavement, obstructions visible on ground surface, underground structures and utilities indicated to be removed.
- B. Sloping and Benching: Follow OSHA recommendations based on soil type to determine slope configurations. Slope the sides of excavations five (5') feet deep and over to the angle of repose of the material excavated; otherwise, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.
- C. Bracing and Shoring:
  1. Provide bracing and shoring as required in excavations, to maintain sides and to protect structures from settlement.



2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
  3. Remove shoring and bracing before completion of backfilling except where required for structural support or slope stability.
  4. The design, installation, and maintenance of such shoring and bracing required to accomplish the above purpose are the sole responsibility of the Contractor.
  5. Follow OSHA recommendations for bracing and shoring.
  6. Indemnify the Owner, the Landscape Architect, Architect, and the Consulting Engineers against any action arising from damage to existing structures, utilities or injury to persons resulting from the Contractor's actions or failure to act, in carrying out the intent of this section.
- D. Protections: Protect structures, vegetation, utilities, sidewalks, pavements, and other facilities in areas of work. Barricade and secure open excavations and provide warning lights/signage from dusk to dawn each day.
- E. Extent of Excavations: Excavate for structures to elevations and dimensions shown, extending excavation a sufficient distance to permit placing and removal of other work and for review. Trim bottom to required lines and grades to provide solid base to receive concrete or imported granular backfill material.
- F. Unsatisfactory Soil Materials: When unsatisfactory soil materials, as defined in this specification, are encountered at design elevations, immediately notify the Architect in writing by email or other equally expeditious means. Continue as directed by the Architect and Geo-Technical Engineer. When, in the sole opinion of the Architect, conditions are not a result of Contractor's negligence, additional excavation may be directed by the Architect and paid for as a Change Order on a unit price or negotiated price basis in accordance with Contract Documents. This additional excavation shall be measured each day and verified by the Owner's representative and the Contractor's Superintendent. A daily written accounting, attested by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. **Assume 2,500 cy of undercutting and removals, placement of soil stabilization fabric (SSF) and providing and compacting to 95% density imported granular backfill material in Base Bid. Unit price provided shall be utilized to add to or delete from this assumed quantity to account for actual quantity encountered.**
- G. Unauthorized and Over Excavation: Consists of removal of materials beyond required subgrade elevations or dimensions without specific direction of the Architect or Geotechnical Engineer. Unauthorized or over excavation, as well as remedial work directed by the Architect or Geotechnical Engineer, shall be at Contractor's expense. Fill of unauthorized excavations shall be as follows (all at no additional cost to the Owner):
1. Fill the voids created by the removal of materials beyond indicated subgrade elevations with lean concrete (2000 psi). Or;
  2. Extending the indicated bottom elevation of the concrete footing to the lower elevation. Or;
  3. Adding imported granular backfill material compacted to 95% density to proper design elevation and layout as directed by the Architect. Testing agency to perform compaction testing prior to proceeding.

H. Dewatering:

1. Contractor shall anticipate seasonal variations of soil moisture content and groundwater in the Base Bid as verified by site investigation indicated in Section 311201.
2. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
  - a. Surface and ground water shall be intercepted and removed before entering excavations. All necessary measures shall be taken. Earth dikes, ditches, or other devices, if required, shall be constructed to prevent such flows.
3. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - a. 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.
  - b. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
  - c. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
4. The Contractor shall at all times provide and maintain proper and satisfactory means and devices (i.e. ditches, temporary pipes, pumps, and/or other temporary construction) for the removal of all water entering the excavations. Water shall be removed as fast as it may collect, in such manner that shall not interfere with the execution of the work or in the proper placing of pipe, structures or other work.
5. Provide and operate sufficient pumping machinery to keep excavated parts free of water. Dig sump pits when necessary into which the excavation shall be drained. Take care and proper precautions in the use of pumps so that in no case will foundations, footings and utilities already in place or existing foundations, footings of adjacent structures or utilities be undermined or disturbed, and erosion occur due to pumping.
6. Do not discharge pumped materials into any body of water, wetland, adjacent property, roadside swales, subsurface storm systems, or any infiltration practices as determined by the Architect. Provide temporary sediment basins, traps, and filter bags for pumped water.
7. Adjust, repair, replace, or clean all work, surfaces, and property, which may have been affected as a result of any dewatering operation.

- I. Prepare subgrade and twelve (12") inches of existing sub-soils below subgrade elevations in excavated areas to minimum density of 95% in structure, pavement, utility areas, trenches, and 90% under lawn non-paved areas.

J. Rock and Rock Excavation:

1. Rock Definition: Shall be defined as solid hard material located in ledges, bedded aggregate deposits and unstratified masses, and all-natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock, which must be removed by pneumatic hammers. Rock does not include shale, slate, soft sandstone, hardpan, masonry or concrete rubble, boulders less than three (3) cubic yards, such other rock material which is decomposed, stratified, weathered or shattered, or any material capable of being removed by a well maintained Caterpillar 225 power shovel, D8 Dozer with Ripper, or Architect approved equivalent.
2. Rock Excavation Administrative Procedures: When encountered, shall be stockpiled for measurement before removal and paid for on a unit price basis in accordance with Contract Documents. Notify Architect immediately of rock discovery prior to performing any rock removal or continued excavation. Rock excavations as defined shall be measured each day and verified by the Owner's designated representative and the Contractor's on-site Superintendent. A daily written accounting, attested to by both parties, shall be maintained with copies daily to the Architect. No claim for extra compensation will be considered except through the procedure outlined above. **Contractor to assume 250 c.y. of rock excavation and removal in Base Bid. Unit price provided shall be utilized to add to or deduct from this assumed quantity to account for actual quantity encountered.**
3. Rock Excavation Removal Procedures: Includes removal and disposal of rock. 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. 8 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.
4. Any over excavation due to rock excavation and removal shall be handled as directed under "Over Excavation" in this Section.
5. Contractor has the option to remove existing rock and dispose off-site or crush existing rock and use as satisfactory general earth fill when it meets gradation noted in 312201 for imported granular backfill material.

### 3.5 BACKFILL AND FILL

- A. Preparation of Ground Surface to Receive Fill: Remove vegetation, organic materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Break up and remove existing foundations, concrete slabs, abandoned utilities, and site features. Plow, strip, roughen, or break up slopes steeper than 1 vertical to 4 horizontal so that fill material will bond to existing surface.

- B. Execute these steps when the existing ground surface, after removal of the above unsatisfactory soil materials, has a density less than that specified under "Compaction" for the particular area classification: Break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to the required depth and percentage of maximum density.
- C. In no case shall fill be placed on a subgrade that is wet, muddy, rutted, spongy, frozen or that contains frost or that has not been tested and approved to achieve satisfactory results.
- D. Areas to receive any fill or backfill should be properly prepared, proof rolled, tested per "Field Quality Control" within this specification, inspected and approved by the Architect and Geo-Technical Engineer prior to the placement of fill.
- E. Following grade approval by the Architect and Geo-Technical Engineer, place imported granular backfill, imported structural fill and satisfactory general earth fill material in layers not more than eight (8") inches in loose depth in a manner to minimize segregation. The fill shall be placed in nearly horizontal lifts commencing at the lowest fill area elevation and proceeding with each lift upward and outward from the lower lift.
- F. Moisture Content: Contractor shall anticipate seasonal variations of all soils (on site or imported) and imported fills moisture content in the Base Bid and timing required for such shall be included in the project schedule. The moisture content of the materials shall be adjusted prior to application of compaction such that it is no more than 1% below or 3% above the optimum moisture content of the material. Apply water to surface, subgrade or layers of soil material when required to achieve compaction densities stated below. Remove and replace, or scarify and air dry, soils or imported materials that is too wet to permit compaction to specified density.
- G. Compaction:
1. Compact each eight (8") inch layer of fill and backfill materials.
  2. Compact fill and backfill material below subgrade for structures, slabs, pavements, and utilities to minimum 95% of optimum in place density as determined by ASTM D1557, Modified Proctor.
  3. Compact fill material below subgrade for lawns or unpaved areas to minimum 90% of optimum in place density as determined by ASTM D1557, Modified Proctor.
- H. Equipment:
1. Use sheepsfoot rollers, pneumatic tired rollers, drum rollers, vibrating tampers, and other compaction equipment capable of obtaining the required density throughout the entire layer being compacted.
  2. Use power-driven hand tampers for compacting materials adjacent to site structures.
  3. For utility trenches or other confined areas, small compaction equipment may be necessary such as a vibratory plate, jumping jack or walk-behind vibratory roller. In these cases, lift heights no greater than six (6") inches should be maintained.
- I. Reconditioning Compacted Areas: Where previously completed compacted areas are disturbed by subsequent construction operations (by any Contractor), traffic or adverse

weather, scarify and dry out the surface, regrade, and recompact to the required density prior to further construction at no additional cost to the Owner. Use hand tamping for recompaction over underground utilities and trenches.

### 3.6 FIELD QUALITY CONTROL TESTING AND INSPECTION SERVICES

- A. Soil Testing Service/Geo-Technical Engineer must inspect and approve density tests, retesting, and proof rolling of subgrades, as described in this section, before further construction work is performed thereon.
- B. Perform compaction density testing on compacted fill and imported granular base course in accordance with ASTM D1556, ASTM D1557, ASTM D2922, and D3017.
- C. In place density testing should be performed at a frequency of one (1) test per 500 square feet per lift in smaller open areas, one (1) test per 2,500 square feet per lift in larger open areas, and one (1) test per 25 feet per lift in confined areas and utility trenches.
- D. When the test results indicate that insufficient compaction has been obtained in any layer, the Contractor shall take action to modify or alter the moisture content in the soil, to provide additional compaction and testing or otherwise to increase the in-place soil density. If the Contractor cannot obtain satisfactory compaction due to material properties, the Contractor shall remove the unsatisfactory material and replace with new material at no additional cost to the Owner.
- E. Materials contaminated by mud, debris, organics, frost, and/or other deleterious materials shall be removed and replaced with uncontaminated specified material.
- F. No fill or backfill shall be placed over an area or lift of fill that has not be tested and achieved satisfactory results.
- G. Proof Rolling: On pavement subgrades, in cut areas only, unless otherwise directed by the Architect, the only testing required will be the proof rolling as described below:
  - 1. Provide Soil Testing Service/Geo-Technical Engineer with 48-hour advance notification when subgrades are ready to proof roll.
  - 2. Proof Roll the prepared pavement subgrade surface with fully loaded ten (10 c.y.) cubic yard earth moving truck or, in the opinion of the Architect/Geo-Technical Engineer, using a 5-ton smooth drum roller making at least 3 overlapping passes, in each of 2 perpendicular directions, on static mode at a speed of 1 to 4 feet/second. Check for unstable areas. Subgrades that rut, pump or deflect under the truck's tires may be judged unstable by the Architect/Geo-Technical Engineer. These areas may require further compaction or undercutting as directed by the Soil Testing Service/Geo-Technical Engineer.

### 3.7 AS-BUILT SURVEY

- A. Provide full as-built survey in AutoCAD .dwg format with stamped .pdf electronic files to the Architect for approvals. Survey shall include: spot elevations, contours, drainage pipes and structures with installed inverts, utilities, and all site pavements and elements)

- B. Survey shall be conducted by a NYS Licensed Surveyor.
- C. Areas to be surveyed include ALL completed proposed site work to a minimum of 15'-0" beyond

### 3.8 GUARANTEE

- A. Guarantee concrete slabs, pavements, curbs, stairs, trenches, utilities, structures, and lawns free from settlement for a period of one (1) year from the date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later.
- B. Repair to proper grade and alignment any and all settlement of concrete slabs, pavements, curbs, stairs, trenches, utilities, structures, and lawns adversely affected by settlement within one (1) year after date given on the certificate of substantial completion or final punch list when satisfactorily completed and accepted by the Architect, whichever is later, at no additional expense to the Owner. In damaged compacted areas, scarify the surface, re-shape, and compact to required density prior to further construction.
- C. All repairs/corrections shall be completed to the satisfaction of the Owner within seven (7) days of written notice by the Owner.

### 3.9 CLEAN UP

During the contract and at intervals as directed by the Architect and as earthwork is completed, clear the site of surplus earth, large surface stones, debris, tools and equipment. Leave the site in a clean, safe, well draining, and neat condition.

END OF SECTION 312201

## SECTION 312501 - EROSION, SEDIMENT AND POLLUTION CONTROL

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Provide erosion, sediment and pollution controls as shown on the drawings and as directed by the Architect to significantly reduce runoff on downstream and neighboring properties. This includes temporary control measures to mitigate land disruption by other Contractors during construction of this project.
- B. Erosion, sediment and pollution control includes, but is not limited to, the following:
  - 1. Storm structure protection
  - 2. Silt fence
  - 3. Rip rap
  - 4. Off site sediment tracking controls
  - 5. Temporary concrete washout facility
  - 6. Temporary seeding and mulching
  - 7. Permanent sodding
  - 8. Construction site dust control
  - 9. Spill prevention, reporting and documentation
  - 10. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.
- D. Code Compliance: The New York State Department of Environmental Conservation requires a SPDES General Permit for Storm Water Discharges from Construction Activity. This Permit GP-0-25-001 is pursuant to the Environmental Conservation Law and has penalties and fines related to violations.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312201 - Site Earthwork
- C. Section 329201 – Sodded Lawns
- D. Section 334001 - Storm Drainage

#### 1.3 REFERENCES

- A. Spill Guidelines Manual (SGM) New York State Dept. of Environmental Conservation.

- B. New York State Standards and Specifications for Erosion and Sediment Control, dated July 2016 or latest edition.

#### 1.4 SUBMITTALS

- A. Manufacturer's Data (MPD) are required for:
  - 1. Storm Structure Protection
  - 2. Silt Fence with Net Backing
  - 3. Soil Stabilization Fabric for Off Site Sediment Tracking Control
  - 4. Spill Response Equipment
- B. Material Certificates (MC) showing content/mechanical analysis and Samples are required for:
  - 1. Rip Rap
  - 2. No. 3 Stone for Off Site Sediment Tracking Control
  - 3. Temporary Seeding and Mulching: Submit seed mix species and mulch source
  - 4. Permanent Sodding: (See Section 329201)
- C. Certification Statement: Submit photocopy of Section 312501, 1.7, filled out completely and accurately to the Landscape Architect at the pre-construction meeting.
- D. Listing of emergency contract numbers. This list shall include the name of an Emergency Response Contractor that may be used in certain situations.
- E. Per NYSDEC SPDES Regulations, all onsite contractors performing earth disturbing activities need to have current NYSDEC endorsed 4-hour erosion and sediment (E&SC) training. Provide copies of all onsite personnel certification cards, prior to construction. The document shall be kept on file (by the Contractor) within the onsite SWPPP log book.

#### 1.5 QUALITY ASSURANCE

- A. Perform erosion, sediment and pollution control in compliance with applicable requirements of the New York Standards and Specifications Erosion and Sediment Control Manual, dated July 2016 (or latest edition) or other governing authorities having jurisdiction.
- B. Prevention of erosion and pollution from storm water runoff for the duration of this project is the responsibility of this Contractor. All Storm Water Pollution Prevention control work indicated on the drawings and/or specifications shall be included in this Contractor's Base Bid. Damages resulting from, but not limited to, negligence, improper maintenance or general disregard for erosion control measures shall be immediately corrected by this Contractor to the satisfaction of the Landscape Architect, Engineer, or Certified Erosion Control Specialist hired by the Owner for SWPPP inspections as required by NYSDEC. Damages resulting from other contractors shall be repaired by this Contractor on a time and materials basis and back charged to the responsible party.



Any fines levied on the Owner by governing authorities for SWPPP violations shall be back charged to the responsible party.

- C. In the event of a chemical or hazardous spill or release, the individual(s) who caused the spill is responsible for prompt and proper clean-up. If the spill requires cleanup procedures beyond the means of the Contractor, an emergency spill cleanup Subcontractor shall be hired by the Contractor. They shall be utilized when the Contractor does not have the appropriate training, equipment or materials to cleanup the area safely and effectively. This shall be done at no additional cost to the Owner. Any testing and cleanup required post cleanup shall be provided by the Contractor at no additional cost to the Owner.

## 1.6 JOB CONDITIONS

- A. Job conditions in Sections 311201, 312201, 329201 and 334001 apply.
- B. Contractor will take all necessary precautions to avoid allowing dust generation that violates NYSDEC regulations and compromises compliance with governing authorities air monitoring plan.
- C. Winter Stabilization Requirement: When construction schedule, regardless of reason, prohibits installation of permanent stabilization measures and site elements, including substantial lawn growth to prevent erosion, this Contractor shall install and provide temporary seeding, mulching, and other preventative/stabilization measures specified and as directed by the Landscape Architect at no additional cost to the Owner.

## 1.7 CERTIFICATIONS

- A. Authorized, legally responsible signatures for the General Contractor, Site Contractor, Site Earthwork, Landscaping Subcontractor(s) and any other soil disturbing Contractor shall sign and prominently display the following certification statement at the job trailer or office during the life of the project:

"I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the Storm Water Pollution Prevention Plan (SWPPP) and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I am aware that there are significant penalties for submitting false information, that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations."

|    |                    |            |       |
|----|--------------------|------------|-------|
| 1. | General Contractor | Signature: | _____ |
|    |                    | Name:      | _____ |
|    |                    | Title:     | _____ |

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

Phone No.: \_\_\_\_\_

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

2. Site Earthwork Contr. Signature: \_\_\_\_\_

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

Title: \_\_\_\_\_

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

Phone No.: \_\_\_\_\_

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

3. Site Landscaping Contr. Signature: \_\_\_\_\_

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

Title: \_\_\_\_\_

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

Phone No.: \_\_\_\_\_

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

4. Other Sub Contractors as determined by the Architect Signature: \_\_\_\_\_  
Name: \_\_\_\_\_

Title: \_\_\_\_\_

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

Phone No.: \_\_\_\_\_

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

## 1.8 NOTICES

- A. The Operator (Owner) shall file with the New York State Department of Environmental Conservation (NYSDEC) a Notice of Intent (NOI) a minimum of ten (10) days prior to start of construction. Unless notified by the NYSDEC to the contrary within ten (10) days, a general SPDES permit is automatically issued which authorizes discharge of storm water on the construction site.
- B. When the site has been finally stabilized, the Operator (Owner) shall file with the NYSDEC a Notice of Termination (NOT).
- C. The Operator (Owner) is responsible for payment of annual fees related to the SPDES permit. Filing of a NOT shall typically terminate the Operator's fee responsibility.

## 1.9 INSPECTIONS AND MAINTENANCE

- A. The Architect or qualified personnel of the Operator shall inspect disturbed areas of the construction site at least once per week. Special attention will be focused on areas not finally stabilized, structural control measures, point discharge (outlets) and locations where vehicles enter or exit the site. Disturbed areas will be inspected for pollutants entering the drainage system. Structural control measures will be reviewed for effectiveness in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site will be inspected for evidence of off site sediment tracking. A written report of inspections shall be produced in a journal during the construction operations. The journal shall be made available (by the Operator/Owner) for NYSDEC and the general public to review.
- B. The Contractor shall provide timely maintenance of vegetation erosion and sediment control measures, and other protective measures, during construction. Corrective measures must be performed within one (1) calendar day of the Architect's or Operator's (Owner's) report. Failure by the Contractor to perform corrective work within this schedule automatically authorizes the Operator to hire others and backcharge this Contractor. The Architect or Operator will send a letter or email correspondence one (1) calendar day before hiring others and backcharging this Contractor. The Contractor shall keep a written record of maintenance and corrective work in a journal. The journal shall be made available for the Operator, Architect, Landscape Architect, Soil and Water Conservation District, ACOE, and NYSDEC until the site is finally stabilized.
- C. The Contractor shall conduct daily inspections of the equipment staging and maintenance, fueling, hazardous waste staging and waste storage areas to ensure that spill control measures are in place. Stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored on site.
- D. The Contractor is responsible for having mandatory, up to date NYSDEC endorsed 4-hour erosion and sediment control (E&SC) training all personnel working on site in accordance with the SPDES permit.

- E. The Operator (Owner) shall provide long term maintenance of the storm water facilities after the site is finally stabilized. The designated maintenance personnel shall keep written records and pictures of maintenance and corrective work in a journal. All stormwater discharge points shall be maintained, inspected, and documented. The journal shall be made available for review by the NYSDEC for a minimum period of five (5) years after the Notice of Termination (NOT) has been filed.

#### 1.10 SPILL PREVENTION, REPORTING AND DOCUMENTATION

- A. To minimize the potential for discharge to the environment of oils, petroleum, or other hazardous substances, the following requirements shall apply:
1. All oil, petroleum, or hazardous materials stored or temporarily relocated on site during the construction process shall be stored in a way to provide protection from vehicular damage and to provide containment of leaks or spills. Temporary berms, dikes, storage basins, or similar methods shall be employed as appropriate on site.
  2. Refer to Storm Water Pollution Prevention Plan Notes for additional spill prevention good housekeeping practices.
  3. Maintain file of Material Safety Data Sheets (MSDSs) or other references for recommended spill clean-up methods and materials.
  4. Keep spill response equipment readily accessible.
- B. In the event of a spill contact the Construction Manager, Owner (Operator), and Architect. The Contractor shall also notify all other Contractors working around the area of the spill.
- C. If spilled material has entered any sanitary/storm sewer system then contact the municipality or agency with jurisdiction over the system, in addition to those listed in this section.
- D. The contractor shall be responsible for the initiation of spill reporting and documentation procedures. All petroleum spills must be reported to NYSDEC Spill Hotline at 1-800-457-7362, less than two (2) hours following discovery. All petroleum spills must be reported to NYSDEC unless all of the following apply:

| Criteria    | Description                                                                                                 |
|-------------|-------------------------------------------------------------------------------------------------------------|
| Quantity    | Must be known to be less than 5 gallons.                                                                    |
| Containment | Must be contained on an impervious surface or within an impervious structure. No access to the environment. |
| Control     | Must be under control and not reach a drain or leave the impervious surface.                                |
| Cleanup     | Must be cleaned-up within two (2) hours of occurrence.                                                      |
| Environment | Must not have already entered into soil or groundwater or onto surface water.                               |

- E. A release of a “reportable quantity”<sup>1</sup> or unknown amount of a hazardous substance must also be immediately reported to the NYSDEC Spill Hotline. Spills of reportable

quantities of chemicals or “harmful quantities”<sup>2</sup> of oil to navigable waters must be reported to the federal National Response Center, 1-800-424-8802 or 1-202-426-2675.

<sup>1</sup> *Reportable Quantity*: Refers to the quantity of a hazardous substance or oil that triggers reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA) (USEPA, September 1992).

<sup>2</sup> *Harmful Quantity*: Includes discharges that violate applicable water quality standards, cause a film, sheen, or discoloration on a water surface or adjoining shoreline; or cause a sludge or emulsion to be deposited beneath the water surface or shoreline (40 CFR 110.3).

## PART 2 - PRODUCTS

### 2.1 STORM STRUCTURE PROTECTION

- A. Shall be a pre-manufactured cylindrical log 12” – 32” in diameter, composed of degradable geotextile mesh tube filled with compost filter media to filter sediment and other pollutants. Filter socks may be filled after placement by blowing compost into the tube pneumatically or filled at a staging location and moved into its designated location. Both ends of the filter socks shall be secured to prevent opening.
- B. The flat dimension of the sock shall be at least 1.5 times the nominal diameter of the sock.
- C. Compost infill shall be a well decomposed (matured at least 3 months), weed-free, organic matter. Shall be aerobically composted, possess no objectionable odors, and contain less than 1% by dry weight, or manmade foreign matter.
- D. All biosolids compost must meet NYS DEC’s 6NYCRR Part 360 (Solid Waste Management Facilities) requirements.
- E. When using compost filter socks adjacent to surface water, the compost should have a low nutrient value.
- F. Wood stakes shall be a minimum of 2" x 2" in size. Shall be untreated fir, redwood, cedar or pine and shall be cut from sound timbers. Shall be straight and free of loose and unsound knots or other defects which would render them as unfit for the intended use. Metal stakes may not be used as an alternate. Tops of stakes shall not extend above the top of the fiber roll.
- G. Standard of quality shall be: Diamond SOCK® pre-filled compost filter sock as manufactured by MKB Stormwater Innovation, 888-578-0777; or Architect Approved Equal

### 2.2 SILT FENCE

- A. Shall be a woven polypropylene geotextile comprised of UV stabilized polypropylene slit film and 1.25" square, non pressure treated, pointed, hardwood posts and net mesh backing for additional support. Standard of quality for silt fence shall be IVI-3611MW as

manufactured by Indian Valley Industries, Inc., [www.iviindustries.com](http://www.iviindustries.com), (607) 729-5111, or Architect approved equal.

### 2.3 RIP RAP

- A. Medium: Shall be placed rip rap. Stones conforming to NYSDOT Table 733-21A, Stone Filling Item "Medium". 50% to 100% shall be heavier than 100 lbs. and 0% to 10% may be smaller than 4".
- B. Gradation of rip rap shall be accepted or rejected based on a visual examination by the Architect prior to placing rip rap.
- C. Soil Separation Fabric: Shall commercially manufactured non-woven polypropylene filter fabric. Standard of quality shall be Mirafi 140N as manufactured by NICOLON/MIRAFI GROUP or Architect approved equal.

### 2.4 OFF SITE SEDIMENT TRACKING CONTROLS

- A. No. 3 stone shall meet the following requirements:

| Standard ASTM Sieve Size | Percent Passing by Weight |
|--------------------------|---------------------------|
| 3"                       | 100                       |
| 2"                       | 0-15                      |
| Passing No. 50           | 5-10                      |
| Passing No. 100          | 2-5                       |

- B. Soil Stabilization Fabric: Shall be a commercially manufactured, UV stabilized low clogging, high flow, woven geotextile. Standard of quality shall be Mirafi 600X, as manufactured by NICOLON/MIRAFI GROUP, 3500 Parkway Lane, Norcross, Georgia (Tel. 1-800-234-0484) or Architect approved equal.
- C. Granular Base Course Material (for Type 2 only): Shall be as specified in Section 312201.

### 2.5 TEMPORARY CONCRETE WASHOUT FACILITY

- A. Concrete washout facility to fully contain all concrete washout needs of the entire project and all contracts.
- B. Concrete washout facility shall be temporary straw bales that are lined with a single sheet of a minimum of 10 mil polyethylene sheeting that extends over the entire basin to prevent escape of discharge. Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to inclement weather to prevent accumulation and overflow of precipitation.
- C. Provide concrete washout to prevent discharge from concrete trucks or equipment cleaning to inlets, surface or groundwater.

- D. Concrete washout facility shall be no closer than 50 feet from environmentally sensitive areas such as waterbodies, wetlands, and open drainage facilities and watercourses. Signs shall designate concrete washout facilities.
- E. Ensure that the concrete washout facility complies with all Federal, State and local laws, rules, and regulations. Ensure that the concrete washout facility is in place before delivery of concrete to site.
- F. Provide a sign identifying area as "Concrete Washout" acceptable to the Architect. Maintain throughout the project duration.

## 2.6 TEMPORARY SEEDING AND MULCHING

- A. Seeding shall be 100% Perennial Ryegrass with no more than 30% of any one cultivar and always at least 2 different cultivars and a 90% germination rate or more.
- B. All seed mixtures to contain 0.5% weed seed or less.
- C. All seed must be fresh seed, not seed that is left over from last year and beyond the sell by date.
- D. Dry mulch shall be clean straw bales.

## 2.7 PERMANENT SODDING

Sodding shall be as specified in Section 329201.

## 2.8 SPILL RESPONSE EQUIPMENT

- A. The following is a list of recommended spill control material. The contractor is responsible to have spill control and personnel protective equipment readily available for the materials being used. Acquire sufficient quantities and types of appropriate spill control materials needed to contain any spills that can be reasonably anticipated. The need for equipment to disperse, collect and contain spill control materials should be on site at all times.
  - 1. Personal Protective Equipment
    - a. Chemical Splash Goggles
    - b. Gloves
    - c. Boot Covers
    - d. Tyvek Aprons or Suits
  - 2. Absorption Materials
    - a. Spill Pillows and Socks
    - b. Absorbent Booms and Pads
    - c. Dikes for use on rough surfaces
    - d. Storm Structure Covers

- e. "Loose" Absorbents
- 3. Tools
  - a. Shovel, Broom, Brush
  - b. Disposal Bags
  - c. Sealing Tape
  - d. Hazardous Waste Stickers
  - e. "Danger" and "Keep Away" Signs
  - f. Five gallon pails or 20 gallon drums with polyethylene liners
- B. Basis of Design shall be provided by: 3M, 888-364-3577; New Pig Corporation, 800-468-4647; SpillKits911, 800-474-5911; Dawg, Inc., 800-935-3294; or Architect approved equal.
- C. Place spill response equipment in a readily assessable location within or immediately adjacent to the project site.

## PART 3 - EXECUTION

### 3.1 SIGNATURE REQUIREMENTS

- A. Between the Pre-Construction Meeting and starting site work, the Contractor shall:
  - 1. Sign the certification statements. Contractor shall prominently display the statements at the job site.
  - 2. Review inspection and maintenance procedures. Decide where journals will be temporarily stored for review by NYSDEC, S&WC, ACOE, Operator (Owner), the Landscape Architect and Architect.
  - 3. Designate specific Owner and Contractor personnel responsible for daily inspection and maintenance. Provide certification cards.

### 3.2 GENERAL EROSION CONTROL

- A. Install initial construction erosion control features, as indicated on drawings and specifications or as directed by the Architect, prior to topsoil stripping, earthwork, and removal of existing vegetation. Keep the disturbance to a minimum and shall not exceed five (5) acres, unless directed by the Architect. Install other features as described in the sequence of erosion, sediment and pollution control on the drawings.
- B. Start permanent seeding and mulching within seven (7) calendar days of rough grading. When this is not possible for any reason, provide temporary seeding on non-roof, non-paved areas with 100% perennial rye grass at the rate of six pounds (6#) seed per one thousand (1,000 sf) square feet and straw mulching for complete coverage. When adverse weather conditions prevent good germination, repeat seeding and mulching as directed by the Architect until the area is stabilized. Till under temporary grass and fine grade when preparing for final permanent lawn stabilization.



- C. Until a disturbed area is stabilized, trap runoff sediment by the use of sediment debris basins, diversion swales, sediment traps, or other methods acceptable to the Architect and governing authorities. Provide temporary dry mulch (straw) to stabilize exposed soils as directed by the Architect.
- D. Provide erosion controls on slopes and swales traversing, bordering, or leaving the site. Limit the water flow to a nonerosive velocity.
- E. Do not store fill materials within one hundred (100') feet of the banks of any streams or waterbodies, intermittent or perennial.
- F. Inspect erosion and sediment control measures immediately after each rainfall and at least daily during prolonged rainfall. Make required repairs immediately.
- G. Remove sediment deposits when they reach approximately one-half of the height of the barrier. Dispose sediment in a manner that does not result in additional erosion or pollution.
- H. Provide prompt (weekly) removal and disposal of rubbish and debris in accordance with the governing authorities, Owner policies, and good housekeeping measures.
- I. Traffic shall not be permitted to cross filter socks.

### 3.3 MUNICIPAL SEWER, SWALES AND WETLAND EROSION CONTROL

Control erosion, siltation and pollution to municipal sewers, swales and wetlands by taking appropriate measures such as, but not limited to, the following:

- A. Do not disturb the bed and banks of waterbodies unless specifically shown on drawings. When bed and bank work is shown, obtain permits and proceed with work creating the minimum disturbance necessary to complete the project.
- B. Prevent petroleum products and excessive amounts of silt, clay, and muck from entering municipal sewers, waters, swales or wetlands of New York State during construction.
- C. Prevent fresh concrete, concrete leachate, and washings from equipment and trucks, from entering municipal sewers, waters, swales or wetlands of New York State during construction.
- D. Place silt fence to control erosion at the downslope edge of disturbed areas. This barrier to sediments is to be put in place before disturbance of the ground occurs and is to be maintained in good condition until disturbed land is heavily vegetated or otherwise permanently stabilized.
- E. Seed areas of soil disturbance resulting from this project with appropriate perennial grass seed and mulched with straw within seven (7) calendar days as described in general erosion control. Mulch shall be maintained until a suitable vegetative ground cover is established and as directed by the Architect.

### 3.4 CONSTRUCTION SITE DUST CONTROL

- A. The Contractor shall prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety issues.
- B. Dust control applies to construction roads, access points, other disturbed areas and stockpiles subject to surface dust movement and dust blowing.
- C. Contractor may use any number and combination of dust control methods, as approved by the Architect. They include:
  - 1. Applying water to haul roads
  - 2. Restricting vehicle speeds to 10 mph
  - 3. Hauling materials in properly tarped or watertight containers.
  - 4. Covering stockpiles and materials
  - 5. Wetting equipment and work area
  - 6. Mulching
  - 7. Spray adhesives and polymer additives (MSDS sheets required)
  - 8. Barriers and wind breaks
- D. Contractor is responsible for any cleanup and site restoration associated with dust control measures, dust pollution on or off the project site property at no additional cost to the Owner.

### 3.5 STORM STRUCTURE PROTECTION

- A. Install fiber rolls as detailed around drainage structures and where shown on the plans to protect site elements from silt and sediment.
- B. Filter socks shall be anchored in earth with wooden stakes driven a minimum of 12" into the soil on 4-foot centers on the centerline of the sock. On uneven terrain, effective ground contact can be enhanced by the placement of a fillet of filter media on the disturbed area side of the compost sock.
- C. Wrapping the storm structure grate with fabric is NOT acceptable, however straw bales may be used.
- D. Upon stabilization of the area contributory to the sock, stakes shall be removed. The sock may be left in place and vegetated or removed in accordance with the SWPPP. For removal, the mesh can be cut, and the compost spread as an additional mulch to act as a soil supplement.

### 3.6 SILT FENCE

- A. Locate as shown on drawings and as directed by the Architect. Excavate trench along the lower perimeter(s) of site, along the contract limit line, and as indicated on the drawings. Place excavated material on uphill side of trench for backfilling.

- B. Drive stakes securely into the downhill side of the trench. When prefabricated silt fence with fabric attached to stakes is used, drive stakes so that fabric is buried in the ground as detailed.
- C. Backfill trench with excavated material, so that fabric is securely buried in the ground to prevent undermining. Tamp soil.
- D. Join sections by overlapping fabric between two (2) stakes. Set stakes simultaneously. Overlap by minimum six (6") inches, fold, and staple to prevent sediment bypass.
- E. Attach silt fence securely to stakes spaced no more than eight (8' o.c.) feet on center. Secure fence fabric to stake with minimum three one (1") inch staples.
- F. Toward the end of the project, when site is stabilized and as directed by the Architect, remove silt fence and correct lawn area around removal to a smooth, neat, well-draining condition.

### 3.7 RIP RAP

- A. Place and install rip rap where shown on drawings. Do not leave jagged, sharp pieces of stone facing up.
- B. Level out stone to provide smooth transition to adjacent finish grades.

### 3.8 OFFSITE SEDIMENT TRACKING CONTROLS

- A. Install as detailed and shown on drawings to eliminate tracking sediment off site. Inspect after each rain storm and at the end of each work day.
- B. When sediment begins tracking off site, sweep and clean affected roadway immediately and replace stone with clean No. 3 stone to retain sediment on site.
- C. Remove fabric and stone at project completion. Complete construction of proposed final surface(s).

### 3.9 TEMPORARY CONCRETE WASHOUT FACILITY

- A. Install per detail in a location as approved by the Owner. Provide a stable surface, easily accessible by concrete trucks.
- B. A sign shall be installed adjacent to each washout facility to inform concrete equipment operations to utilize the proper facilities. The sign shall be installed as detailed and maintained throughout the project.
- C. Temporary concrete washout facility shall be constructed and maintained in sufficient quantity and size to contain all liquids and concrete waste generated by washout operations for the entire project and by all Contracts.

- D. Perform washout of concrete mixers, delivery trucks, and other delivery systems in designated areas only.
- E. Wash concrete only from mixer chutes into approved concrete washout facility.
- F. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material. Liner seams shall be installed in accordance with manufacturers' recommendations.
- G. Contents of the concrete washout facility shall not exceed 50% capacity of the facility. At or before 50% capacity is reached, discontinue pouring concrete until the facility is cleaned out. Remove hardened concrete and properly dispose off site. Allow slurry to evaporate or remove from site and dispose off site. Immediately replace the liner if it gets damaged.
- H. Remove concrete washout facility when it is no longer needed as directed by the Architect.

### 3.10 TEMPORARY SEEDING AND MULCHING

- A. Provide temporary seeding of topsoil stockpile immediately.
- B. When necessary and as directed by the Architect, provide temporary seeding and mulching on disturbed areas at no additional cost to the Owner.

### 3.11 PERMANENT SODDING

- A. Install as described in Section 329201.

### 3.12 SPILL RESPONSE EQUIPMENT

Use per manufacturer's recommendations and as directed by the NYSDEC, or other governing agencies.

### 3.13 CLEAN UP

- A. During the contract and at intervals as directed by the Architect and as erosion, sediment and pollution control procedures are completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, well draining, and neat condition.
- B. Clean storm ponding areas, catch basins and detention basins: Clean out contaminants, sediment, rubbish, construction debris, foreign objects and accumulated floatables from chambers and ponding areas thoroughly, immediately prior to final acceptance.

END OF SECTION 312501

## SECTION 321201 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of asphalt paving is shown on the drawings.
- B. Asphalt Paving work includes, but is not limited to, the following:
  - 1. Soil Stabilization Fabric
  - 2. Granular Base Course
  - 3. Asphaltic Concrete
  - 4. Bituminous Tack Coat
  - 5. Painted Lines and Traffic Markings
  - 6. Self-Adhering Waterproof Membrane
  - 7. Speed Bump
  - 8. Hot Pour Crack Sealing and Filling
  - 9. Field Quality Control
  - 10. Asphalt Price Adjustment
  - 11. Clean up
- C. Provide all materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation (Asphalt Milling)
- B. Section 312201 - Site Earthwork
- C. Section 334001 - Storm Drainage

#### 1.3 REFERENCES

- A. The latest editions of the following Standards, as referenced herein, shall be applicable:
  - 1. New York State Department of Transportation Standard Specifications, Section 402 - "Hot Mix Asphalt (HMA) Pavements" and 407 - "Bituminous Tack Coat"
  - 2. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
  - 3. American Sports Builders Association (ASBA) Asphalt Guidelines, latest edition
- B. The following reference standards shall apply for Testing and Inspection:

1. ASTM D1074: Standard Test Method for Compressive Strength of Bituminous Mixtures
  2. ASTM D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Mixtures Using Paraffin-Coated Specimens.
  3. ASTM D2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
  4. ASTM D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-absorptive Compacted Bituminous Mixtures
  5. ASTM D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods
  6. ASTM D3203: Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
  7. ASTM D3549: Standard Test Methods for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
  8. NYSDOT Materials Method 28 Friction Aggregate Control and Test Procedures
- C. The following reference standards shall apply for pavement markings:
1. ASTM D562, D711, D1475, D1640, D2369, D3723, D3960.
  2. DOT Code of Federal Regulations, Hazardous Materials and Regulations Board, Reference 49CFR, ICC Regulations
  3. Federal Specification TT-P-115E, Type III (Type I if V.O.C. compliance)
- D. Additional testing required, only if directed in writing by Architect, due to asphalt installation and material issues:
1. ASTM C295: Standard Guide for Petrographic Examination of Aggregate
  2. ASTM D1560: Standard Test Methods for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
  3. ASTM D4125: Standard Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method
  4. ASTM D5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
  5. ASTM D6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
  6. ASTM D6931: Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures
  7. ASTM D7312: Standard Test Method for Determining the Pavement Shear Strain and Complex Shear Modulus of Asphalt Mixtures Using the Superpave Shear Tester

#### 1.4 SUBMITTALS

- A. Provide Paving Contractor experience requirements, as outlined in "Quality Assurance" of this specification section, for the following:
1. General Paving
- B. Provide Asphalt Producer Vendor Certificate and proof of quality control monitoring as outlined in "Quality Assurance" of this specification section.

- C. Provide material certificates showing content/mechanical analysis for the following:
1. Asphaltic Concrete Mix Design with Authorization Signature:
    - a. Type/name of mix (less than 24 months old)
    - b. All aggregates gradations and quality measurements
    - c. Plot (0.45 power graph) of the final aggregate blend
    - d. Bulk (dry) specific gravity of all aggregates and final aggregate blend (Gsb) including worksheets for natural (virgin) as well as reclaimed asphalt pavement (RAP)
    - e. Grade of asphalt binder (PG) being used
    - f. Optimum percent asphalt binder (Pb)
    - g. Mix air voids at optimum (Va)
    - h. Bulk specific gravity of mix at optimum (Gmb)
    - i. Theoretical maximum specific gravity of mix at optimum
    - j. Voids in the Mineral Aggregate (VMA) and Void Filled with Asphalt (VFA)
    - k. Dust to total asphalt content (AC) ratio
    - l. All design data and associated design curves
  2. Bituminous Tack Coat
- D. Provide Manufacturer's Product Data (MPD) for the following:
1. Soil Stabilization Fabric
  2. Painted Lines and Traffic Markings
  3. Self-Adhering Waterproof Membrane
  4. Speed Bump
  5. Hot Pour Crack Sealing and Filling
- E. Provide shop drawings for the following:
1. Painted Lines and Traffic Markings: Shop drawings indicating sizes, shapes, patterns, and colors of markings, including manufacturers and types of paint.
  2. Owner to approve all paint colors prior to installation.
- F. Submit Asphalt Placement Work Plan, indicating paving pass widths, paving directions, site access, and timing/coordination of any site equipment installation (posts, boxes, fencing, etc.) indicated in 3.3 of this specification section. Supply Owner with yield calculations for all asphalt paving products and materials used on the project as part of the work plan.
- G. Field Quality Control test reports as indicated in this specification section.

## 1.5 QUALITY ASSURANCE

- A. Paving Contractor Experience Requirements:

1. General Paving: Contractor shall have the experience of at least five (5) years in business. Paving superintendent has a minimum of three (3) years' experience as a paving crew operating foreman.
- B. Asphalt Testing and Inspection Services:
1. The Owner will employ and pay for the services of an Independent Testing Agency to provide testing and inspections of asphalt pavements.
  2. The services and the information provided by the Testing Agency are provided for the sole benefit of the Owner. The information is provided to the Contractor for the sole purpose of being aware of what is being reported.
  3. The Contractor is solely responsible for assuring the work complies with the Contract Documents in all respects and may not rely on the testing agency for this or any other assurances. The Testing Agency and their representatives are not authorized to revoke, alter, relax, enlarge, or release any of the requirements of the Contract Documents, approve or accept any portion of the work, perform or excuse any duties of the Contractor, or be involved in the scheduling of any work.
  4. Asphalt paving materials and operations shall be tested and inspected as the work progresses. Failure by the Testing Agency to detect any defective work or material shall not in any way prevent later rejection (when such defect is discovered) nor shall it obligate the Owner for final acceptance.
- C. Asphalt producer shall monitor production according to the procedures of NYSDOT Material Method 28 Friction Aggregate Control and Test Procedures. Asphalt producer shall be a New York State approved/certified HMA (Hot Mix Asphalt) manufacturing facility.
- D. Calibrated equipment and qualified personnel must be always accessible during the construction of the HMA.

#### 1.6 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Atmospheric conditions for applying courses:
1. Hot mix asphalt shall generally arrive on the project site between 270°-300° F. (per asphalt producer recommendations).
  2. Place asphalt concrete wearing course or bituminous surface treatment only when atmospheric temperature is above 50 degrees F. and rising, and when asphalt binder course is thoroughly dry.
  3. Place binder course only when air temperature is above 45 degrees F. and rising and when asphalt base course or granular stone base course is thoroughly dry.
- C. Grade Control: Establish and maintain required lines and elevations.
- D. Codes and Standards: Perform the work in compliance with applicable requirements of governing authorities having jurisdiction. Obtain and pay for permits required by local authorities.



- E. Construction Review and Testing: Notify and coordinate with the Independent Testing Agency and Architect when the subgrade is shaped and ready for proof rolling. Also, when the granular base course is fully installed, compacted and ready for density testing. Protect subgrade and subbase at all times.
- F. When staging or scheduling delays occur and wearing course cannot be installed directly after binder course installation before winter, provide temporary asphalt transition ramp/collar around drainage structures in paved areas and at handicap ramps to prevent damage by snow plow. Remove prior to installation of wearing course. Power wash surface and apply asphalt tack coat, as specified, prior to wearing course installation, at no additional cost to the Owner.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver all materials to the job site with all labels intact and legible at time of installation.
- B. Store materials off ground under cover. Protect from damage or deterioration.
- C. Handle materials to prevent damage to surface, edges, ends and factory applied finishes of items. Damaged material shall be rejected and replaced.

#### 1.8 ASPHALT PRICE ADJUSTMENT

- A. Asphalt pricing is based on the NYS Department of Transportation average posted prices for Asphalt Performance Graded Binder (PGB). NYSDOT Website:  
<https://www.dot.ny.gov/main/business-center/contractors/construction-division/fuel-asphalt-steel-price-adjustments>
- B. Asphalt Price Adjustment: The asphalt price adjustment will be based solely on the price changes for asphalt as determined by the formulas below. No adjustment will be made if the monthly average posted price is within \$15.00 of the asphalt index price. No consideration will be given to the situation where an individual supplier's price exceeds the monthly average posted price.
- C. Prices: The Asphalt Index Price and Monthly Average Posted Price are defined as follows:
  - 1. Asphalt Index Price: The asphalt index price is a price per ton of Performance Graded Binder (PGB) used solely as a basis from which to compute asphalt price adjustments. The asphalt index price for original contract bid price items and additional work at the original contract bid price will be the monthly average posted price for the month of the bid letting.
  - 2. Monthly Average Posted Price: The average terminal price for unmodified PG 64-22 binder, without anti-stripping agent, determined by the NYSDOT, based on prices of approved primary sources of PGB.
- D. Adjustment: Asphalt price adjustment will be based on the following formulas:

1. When price Increases:  $\text{Price Adjustment} = (\text{tons} \times \% \text{ asphalt}) \times (\text{Monthly Average Posted Price} - \text{PGB Index Price} - \$15.00)$
2. When price Decreases:  $\text{Price Adjustment} = (\text{tons} \times \% \text{ asphalt}) \times (\text{Monthly Average Posted Price} - \text{PGB Index Price} + \$15.00)$

E. Pavement Types and Percent Asphalt\*:

|                             |              |
|-----------------------------|--------------|
| 37.5mm Type 1 Base Course   | 4.8% Asphalt |
| 19.0mm Type 3 Binder Course | 4.8% Asphalt |
| 9.5mm Type 7 Top Course     | 6.3% Asphalt |

\* Percentage of Asphalt is approximate and shall be based off actual project submittals provided by the Asphalt Producer.

## PART 2 - PRODUCTS

### 2.1 SOIL STABILIZATION FABRIC

- A. Shall be a heavy duty, commercially manufactured woven polypropylene geotextile. Standard of quality shall be Mirafi 500X, manufactured by TenCate or Architect approved equal.

### 2.2 GRANULAR BASE COURSE

- A. Shall be as specified in Section 312201.
- B. The graded and designed granular base below all new Asphaltic Concrete Pavements shall be constructed, tested, and prepared in accordance with Section 312201 - Site Earthwork of the Contract Documents.

### 2.3 ASPHALTIC CONCRETE

| A. Pavement Types           | Percent Asphalt* |
|-----------------------------|------------------|
| 37.5mm Type 1 Base Course   | 4.8% Asphalt     |
| 19.0mm Type 3 Binder Course | 4.8% Asphalt     |
| 9.5mm Type 7 Top Course     | 6.3% Asphalt     |

\* Percentage of Asphalt is approximate and shall be based off actual project submittals provided by the Asphalt Producer.

- B. Hot Mix Asphalt Top Course: Pavement shall meet the minimum requirements for 9.5 mm (Type 7) SUPERPAVE Hot Mix Asphalt Top Course (75 gyrations), with a PG 64-22 Binder as specified in Section 404, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.

- C. Hot Mix Asphalt Binder Course: Pavement shall meet the minimum requirements of 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 404, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 20% of the total mix.
- D. Hot Mix Asphalt Base Course: Pavement shall meet the minimum requirements of 37.5mm SUPERPAVE Hot Mix Asphalt Base Course (75 gyrations), with a PG 64-22 Binder, as specified in Section 402, of the current NYSDOT Standard Specifications, with the exception that the maximum proportion of Recycled Asphalt Pavement (RAP) to virgin aggregates shall not exceed 30% of the total mix.
- E. The coarse aggregate used in HMA shall be sound, angular crushed stone (crushed or rounded gravel is not acceptable). The fine aggregate shall be well graded, moderately sharp to sharp (angular) sands.

## 2.4 BITUMINOUS TACK COAT

- A. Material shall consist of an asphalt emulsion, Grade RS-1h, and shall meet the minimum requirements of Section 407, of the current NYSDOT Standard Specifications. Bituminous Tack Coat shall be installed over all new and existing concrete and asphalt pavements and structures prior to the installation of new Hot Mix Asphalt materials. The following application rates shall apply:
 

|                                                                 |                  |
|-----------------------------------------------------------------|------------------|
| 1. New Hot Mix Asphalt                                          | 0.05-0.07 gal/sy |
| 2. Milled Surfaces of Existing Asphalt                          | 0.10-0.15 gal/sy |
| 3. Abutting Vertical Edges (drainage structures, appurtenances) | 0.05-0.07 gal/sy |
| 4. All Styles of Curbs and Gutters                              | 0.05-0.07 gal/sy |
| 5. Delayed asphalt installation of HMA Courses                  | 0.10-0.15 gal/sy |

## 2.5 PAINTED LINES AND TRAFFIC MARKINGS

- A. The extent of the pavement markings shall match the extent, location and composition of pavement markings existing at the site prior to start of work where applicable.
- B. The work includes, but is not limited to the following: parking stall divider lines, wheelchair legends, "STOP" legends, "NO PARKING" legends, pick-up zone, striping and legends, directional arrow legends, diagonal striping, center line striping, fire lane striping, student area line striping, and other pavement markings as may be shown on the plans.
- C. Provide ready-mixed, one component waterborne traffic line paint. Standard of quality shall be: Pro-Park® Waterborne Traffic Marking Paint B-97 Series as distributed through Sherwin-Williams, 800-474-3794; or Architect approved equal.
  - 1. Colors (as approved by the Owner in writing):
 

|            |                                               |
|------------|-----------------------------------------------|
| a. Yellow: | 1 Gallon & 5 Gallon, Product Number B97YD2467 |
| b. White:  | 1 Gallon & 5 Gallon, Product Number B97WD2434 |

- c. Blue: 1 Gallon & 5 Gallon, Product Number B97LD2022
- d. Black: 1 Gallon & 5 Gallon, Product Number B97BD2021

- 2. Paints shall contain all necessary co-solvents, dispersants, wetting agents, preservatives and all other additives, so that paint shall retain viscosity. Halogenated solvents and glass beads shall not be permitted.
- 3. Volatile Organic Compound (VOC) content shall not exceed 250 grams maximum per liter of paint as determined in accordance with ASTM D 3960 test, excluding water and exempt solvents.

## 2.6 SELF-ADHERING WATERPROOF MEMBRANE

- A. Shall be a composite membrane designed specifically to prevent water from permeating joints and cracks. Product shall be comprised of self-adhering rubberized asphalt and durable poly propylene non-woven fabric with a "peel-n-stick" release. Standard of quality shall be 12" Mirafi MTK as manufactured by TenCate or Architect approved equal.
- B. Priming material composed of refined asphalt and rapid drying solvent meeting ASTM D41. Polyguard 650 RC Liquid Adhesive or Architect approved.
- C. **Contractor to provide 1,000 linear feet in Base Bid.**

## 2.7 SPEED BUMP

- A. Shall be EPDM rubber compound with non-skid surface, end caps and installation hardware. Molded-in cat eye reflectors and bright yellow EPDM strips. Standard of quality shall be Heavy Duty Economy Double Lane Speed Bump as manufactured by Unimat Traffic, 1-855-864-6281 or [www.unimattraffic-usa.com](http://www.unimattraffic-usa.com).
- B. Provide three (3) 12' lengths and three (3) 25' lengths with endcaps and all associated hardware.

## 2.8 HOT POUR CRACK SEALING AND FILLING

- A. Single component, hot applied asphalt crack and joint sealant capable of withstanding temperatures of up to 450° without experiencing polymer degradation.
- B. Shall be supplied in solid blocks comprised of heat stabilized polymers and asphalt.
- C. Meeting the following material requirements when tested in accordance with ASTM D5329. (see chart below)

### Chemical & Physical Analysis

|                                     |           |
|-------------------------------------|-----------|
| Recommended Application Temperature | 350-400°F |
| Maximum Heating Temperature         | 450°F     |

|                          |                   |
|--------------------------|-------------------|
| Cone Penetration at 25°C | 50 max.           |
| Flow at 60°C, mm         | 0.                |
| Softening point          | 200°F Min.        |
| Flexibility 0°F          | (1" Mandrel)-Pass |
| Specific Gravity         | 1.17              |
| Asphalt Compatibility    | Passes            |

- D. Standard or quality shall be Crack Master Supreme as manufactured by Thorworks Industries, Inc., 800-395-7325, [www.thorworks.com](http://www.thorworks.com) or approved equal.

## PART 3 - EXECUTION

### 3.1 PREPARE SURFACE

- A. Prior to commencement of asphalt paving, all excavations, drainage, utilities, backfilling, fencing, bollards, storm structures, curbing installations, adjustments, proof-rolling and density test procedures shall be complete to the satisfaction of the Architect.
- B. Prior to commencement of tack coat and asphalt paving within pavement milled areas, as shown on the plans, all cracks and joints in the milled pavement surface shall be prepared and filled in accordance with the project specifications. Any oil or grease spots shall be scraped and treated to prevent bleeding through the tack coat.
- C. Saw cut, using straight and true lines, all existing asphalt pavements to remain in place with straight, neat edge for abutting against proposed asphalt pavement.
- D. Provide and confirm field quality control as described in Section 312201 for pavement subgrade and granular base course stone.

### 3.2 CONSTRUCT PAVEMENT GRANULAR BASE COURSE

- A. General: Consists of placing granular base course material, in layers of specified thickness, over prepared subgrade and fabric to support a pavement course.
- B. Grade Control: Provide engineering layout per Section 312201 and grade stakes. During construction, protect grade stakes; maintain lines and grades including crown and cross-slope of each course.
- C. Install soil stabilization fabric after subgrade has been acceptably compacted and proof rolled. Install soil stabilization fabric as recommended by the manufacturer AND;
  - 1. Lay fabric in direction of construction traffic.
  - 2. Overlap fabric side to side and end to end a minimum of two (2') feet.
  - 3. Establish reasonable compaction and rut stability before using heavy or vibratory compaction equipment.
- D. Placing:

1. Place granular base material over soil stabilization fabric, on prepared subgrade in layers of uniform thickness, conforming to the asphalt pavement details on the drawings.
  2. Place granular base material in a maximum of six (6) inch layers and compact with a vibratory or 10 ton smooth wheeled roller.
- E. Provide density testing as described in Section 312201.
- F. Surface Smoothness: Test finished surface for smoothness. Surface will not be acceptable when it deviates more than 3/8" measured by a 10 foot straightedge, in any direction.
- G. The finished grade of the granular base course shall be verified to ensure that the final finished product of the bituminous concrete pavement surface will be installed to the lines and grades of the existing pavements and proposed elevations surveyed by the Contractor prior to the start of the paving work.

### 3.3 PLACE ASPHALT MIX

A. General:

1. The Contractor shall submit a paving plan, indicating intended direction of paving, number of pulls, etc. for approval prior to the start of paving operations.
2. Joints: Saw cut vertical straight, neat edges for joints required. Joints shall be sharp and clean, conforming to shapes drawn on drawings. Ragged joints will not be accepted.
3. Mill two (2') feet into surface of adjacent asphalt so joints do not line up or "stack".
4. Place bituminous tack coat to all surfaces as indicated in this specification. When pavement surface temperature is above or below the 75-130 degrees F. range, the grade of asphalt emulsion must be modified according to NYSDOT standards. Tack coat shall not be applied to a wet surface or when the pavement surface temperature is below 45 degrees F.
5. Place asphalt on approved prepared surface, spread and strike-off.
6. Spread mixture at minimum temperature of 225-240 degrees F. Place inaccessible and small areas by hand. Hand work shall be minimized to ensure the best possible finished surface.
7. Place each course to required grade, cross-section, and compacted thickness.
8. Paving operations shall not be scheduled when ample time does not exist to place, compact, and finish roll the hot mix asphalt during daylight hours and prior to rainfall.

B. Pavement Placing: Shall be installed in accordance with Section 402-"Hot Mix Asphalt (HMA) Pavements", of the current NYSDOT Standard Specifications.

C. Paving Equipment:

1. Must be capable of placing, spreading and finishing courses of HMA to the specified thickness.

2. HMA shall be free of marks, segregation and be placed to the required uniform elevation with a smooth texture not showing tearing, shoving, or gouging.
  3. Auger extensions are required while pavers are extended beyond the basic screed width.
  4. Paving equipment shall be self-propelled and capable of maintaining the line and grade shown on the plans with suitable electronic equipment. The screed shall be straight and true with no bow and utilizing a vibratory screed. Paving equipment should have fully functional screed heaters and joint preheaters.
- D. Asphaltic Concrete shall be installed as follows:
1. Heavy Duty Asphalt Pavement: Installed in three (3) lifts consisting of a 37.5mm SUPERPAVE Hot Mix Asphalt Base Course overlain by 19.0mm SUPERPAVE Hot Mix Asphalt Binder Course overlain by 9.5mm SUPERPAVE Hot Mix Asphalt Top.
- E. Place in strips not less than ten (10') feet wide, unless otherwise acceptable. In placing each succeeding pass after the placement of the initial pass, the screed of the paver shall be set such that it overlaps the preceding pass by 6" and be sufficiently high such that when compacted, a smooth joint is produced. Prior to pinching the joint, the excess material shall be pushed onto the edge of the new pass with a lute. Excess material shall be removed.
- F. After first lift has been placed and rolled, place succeeding lifts and extend rolling to overlap previous lifts. Where possible, top course shall be placed at right angles to binder course and in the direction that the drainage flows. Where this is impractical, offset joints of the two courses by a minimum of two (2') feet so upper and lower joints do not align.

### 3.4 ROLL ASPHALT MIX

- A. General:
1. Rollers shall conform to the manufacturer's specifications for all ballasting. At least one vibratory roller shall be required for each project, with two rollers required as a minimum. (Three rollers shall be required when tonnage is greater than 300 tons/day.)
  2. Rollers shall be of a good condition and capable of compacting the HMA to the minimum in-place density required by this specification. Compact asphalt with a nominal 10 ton steel wheel roller or pneumatic rubber tired roller. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
  3. Begin rolling when mixture will bear roller weight without obvious or excessive displacement.
- B. Finish Rolling: Each lift of the Asphaltic Concrete Pavement shall be mechanically rolled and compacted to the finished thicknesses specified in the Contract Documents. The pavements shall be compacted to a minimum of 94%-97% (95%-102% at longitudinal joints) of the materials theoretical density as determined by AASHTO Method T 209 and an air void percentage of 5%-6% maximum.



- C. Patching: Remove and replace paving areas mixed with foreign materials, dirt, and defective areas. Cut-out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.
- D. Joints:
1. The Contractor shall sequence the installation and orientation of all Asphaltic Concrete Pavements such that the minimum numbers of longitudinal and transverse joints are produced and in accordance with the approved Asphalt Placement Work Plan.
  2. Neat, straight butt joints between successive passes. Offset joints a minimum of six (6") inches between lifts of asphalt.
  3. When repairs or staging of work occurs, make neat vertical saw cut between old and new work to create butt joint. Heat joint prior to pouring. Cold joints are not acceptable.
  4. Apply bituminous tack coat to all surfaces and rates indicated under "Bituminous Tack Coat" of this specification section. Tack coat shall not be required on abutting vertical edges for pavements placed in the same day.
  5. Minimize construction, longitudinal, and transverse joints left open for an extended period of time.
  6. Construct longitudinal joints by paving in a hot fashion with a temperature of not less than 220°F to ensure maximum performance and adhesion.
  7. Compact all joints to provide for a neat, uniform and tightly bonded joint that will meet both surface tolerances and density requirements of this specification.
  8. Cut straight and true (vertical construction or transverse joints if the material has cooled to less than 220°F prior to the placement of the next pass to ensure the best performing joint possible.
- E. Edges: Roll at 45 degrees as detailed, creating clean edge conforming to shapes indicated on the drawings. Ragged edges will not be accepted. Return and saw cut ragged edges at no additional cost to the Owner as directed by the Architect.
- F. The final finished grades of the new Bituminous Concrete Pavements must be smooth and true to the contours and shall be installed to the lines and grades of the site prior to start of construction. The final finished grades shall match adjacent pavement surfaces and concrete slabs, aprons, and doorways.
- G. Construction Delays (over 48 hours): When placement of the wearing course over the binder course is delayed over 48 hours, thoroughly clean existing surface of dirt, oil and other debris by pressure washing and sweeping. Place bituminous tack coat as specified in this section.

### 3.5 ASPHALT TOLERANCES

- A. Thickness and Density: Compact each asphalt course to produce the thickness indicated on the drawings within the following tolerances:
1. Base Course: Plus or minus 1/2-inch
  2. Binder Course: Plus or minus 1/4-inch
  3. Wearing Course: Plus or minus 1/8-inch



- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. For Asphalt Concrete:

|                         |      |
|-------------------------|------|
| Base Course Surface:    | 3/8" |
| Binder Course Surface:  | 1/4" |
| Wearing Course Surface: | 1/8" |
- C. Asphalt Cores: Shall be provided as indicated under "Field Quality Control" of this specification.

### 3.6 FIELD QUALITY CONTROL

- A. The Owner's Testing Agency shall provide the following in the daily report at a minimum:
1. Verify the following for the asphalt mix design prior to asphalt placement:
    - a. The asphalt mix design has been approved.
    - b. The asphalt mix design specifies the minimum relative compaction and the methods required to determine maximum density.
  2. Verify the asphalt subgrade has been acceptably proof-rolled. (See Section 312201.)
  3. Inspect /test aggregate base course material for in-place density (95%) and thickness. Test materials for gradation classification, and physical properties. (See Section 312201.)
  4. Inspect/test asphalt wearing course material for compaction during placement and conduct thickness measurements during lay-down. Take temperature of the asphalt mixture and compare actual temperature with the approved asphalt mixture design range. As a minimum, perform the following inspection/tests:
    - a. Collect trip tickets from trucks delivered to the site and verify correct mix design being used for the project.
    - b. Temperature tests: one per truck.
    - c. Lay down thickness (uncompacted): one per strip or 500 square feet minimum
    - d. Verify equipment rolling pattern and passes to ensure proper compaction: one per day
    - e. Density test (daily lab density): one test per 5000 square feet minimum
    - f. Hot mix samples (laboratory testing for density per ASTM D1188): one per day
    - g. Thickness per ASTM D3549 and density samples per ASTM D2950 by a properly calibrated nuclear asphalt testing device. If there is a disagreement between tests done by ASTM D2950 and ASTM D1188, the values done by ASTM D1188 will govern: one test per 20,000 square feet (surface lift), one test per 10,000 square feet (base lift)

- h. Air voids per ASTM D3203 or D2726: one test per 5000 square feet minimum
  - i. Verify compaction at the joints and seams. The completed paved surface to be true to grade and cross section. Verify smoothness by using an unleveled 10 foot straightedge and ensuring no gap at any point between straightedge and pavement exceeds surface smoothness requirements above except at interception or at changes of grade.
  - j. The screed/lay down thickness tolerance shall be between 1/8 to 3/16 inches greater than the required asphalt minimum layer requirement. When screed depth is set for the exact thickness as specified, immediately notify the Owner's Representative and Contractor that the installed asphalt thickness may be deficient to achieve the specified minimum thickness. Identify areas of non-complying thickness and attach a drawing identifying the areas to the daily field report.
  - k. Immediately notify the Owner's Representative and Contractor when paving is being conducted in cold weather and asphalt temperatures are below or above the design mix range.
  - l. Check the surface grades and drainage patterns. Identify on a drawing all paved areas that are holding water after asphalt placement and notify the Owner's Representative and Contractor. Small ponding areas (bird baths) larger than two (2') feet in any dimension are not acceptable. When this test proves that surface conditions are not acceptable, the Contractor will be responsible for correcting the problem areas. Install a one (1") inch shim coat of wearing course material, or other means acceptable to the Architect.
  - m. Verify tack coat and edge coat have been applied at the proper rate.
5. Asphalt Cores: Shall be as directed by the Architect.
- a. Prior to final acceptance of the asphalt and before lining or other surface materials (resilient track surfacing, etc.) are placed, the Owner's Testing Agency shall core 3" diameter areas of the asphalt surfacing where directed by the Architect. Consistency, density, thickness, and tensile strength per ASTM D6931 will be evaluated.
  - b. Patch core areas as directed by the Architect to match adjacent density, texture and thickness.
  - c. Coordinate day to day scheduling with the Testing Agency.
  - d. If cores vary significantly from the contract requirements, additional cores will be performed by the Testing Agency as directed by the Architect. Once the overall general quality is determined, provide remedial work as directed by the Architect to achieve the quality and consistence as specified.

- B. Unacceptable Paving: Remove and replace unacceptable paving as directed by the Architect, immediately and without argument or delay. Correction of deficient areas in the wearing course shall be done by sawcutting and removal of defective area of work. Tack coat shall be applied to all edges and the pavement shall be replaced. Shimming or skin patching of the wearing course shall not be permitted. Correction of deficient areas within the binder course shall be corrected by sawcutting and milling high spots, and truing and leveling low spots or as directed by the Architect.

### 3.7 SURFACE PROTECTION

- A. Protection: After final rolling and sealing, do not permit any type of vehicular or construction traffic on pavement until it has cooled and hardened as recommended by the producer/manufacturer, minimum of 48 hours.
- B. Provide protection including, but not limited to, fencing, traffic cones, barrels, lights, reflective signs, flagpersons and barricades until mixture has cooled and attained its maximum degree of hardness.

### 3.8 PAINTED LINES AND TRAFFIC MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust. Remove dirt, oils and other foreign matter. All surfaces to receive pavement markings shall be clean and in good condition to accept pavement markings.
- B. Coordinate provisions for installation with work of other trades.
- C. Locate to alignment and dimensions as shown on drawings and/or approved by Owner.
- D. Painted markings shall meet regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by NYSDOT, Division of Traffic and Safety, Section 262.25 and figure PM-42; and they shall comply with the most recent version of the Americans with Disabilities Act Standards for Accessible Design.
- E. Protect: Adjacent surfaces and other items to remain with tape, drop cloths, or other Architect approved means.
- F. Application: Two coats according to manufacturer's recommendations resulting in a dense, opaque application without any ghosting of former pavement markings showing through. Overspraying along edges will not be accepted. Edges shall be sharp and crisp, to the shapes required by the drawings.
  - 1. First coat shall be installed at the recommended DFT (dry film thickness) after paving is in place. The second coat shall be applied at the recommended DFT no later than thirty (30) days after the completion of work.
  - 2. Apply paint materials using clean brushes, rollers or spraying equipment.
  - 3. Apply paint materials as a rate not exceeding those recommended by the paint manufacturer for surfaces being painted, less 10% of losses.
  - 4. Comply with manufacturer's recommendations for drying time between coats. The minimum DFT must be met. Apply additional coats as needed to achieve minimum total specified DFT of the paint system.
  - 5. The minimum required total Dry Film Thickness (DFT): The DFT shall be the minimum required thickness as measured in mils.
  - 6. System coverage requirements minimum total thickness (unless otherwise noted):
    - a. 1<sup>st</sup> Coat – 3.0 mils
    - b. 2<sup>nd</sup> Coat – 6.0 mils

7. Exterior Paint Systems: Provide the following paint systems as indicated: (Colors to be approved by Owner.)
- a. Parking stall, division and limit lines shall be 4" in width, true and straight. Color: White – DFT 6.0 mils
  - b. Pavement lettering "NO PARKING" shall be 2'-0" in height. Color: Yellow – DFT 6.0 mils
  - c. Compact lettering "COMPACT" shall be 1'-0" in height. Color White – DFT 6.0 mils
  - d. Stop legends shall be as detailed on drawings. Color: White – DFT 6.0 mils
  - e. Wheelchair legends shall be as detailed on the drawings. Color: Blue background with white symbols. Parking stall striping shall be Blue at handicap stalls only – DFT 6.0 mils
  - f. Diagonal striping Handicapped. Color: Blue – DFT 6.0 mils
  - g. Diagonal striping Loading Zone. Color: Yellow – DFT 6.0 mils
  - h. Directional signage shall be as detailed on the drawings. Color: White – DFT 6.0 mils
  - i. Center line striping shall be 4" in width as detailed on the drawings. Color: White – DFT 6.0 mils
  - j. Fire line striping shall be 4" in width. Color: Yellow – DFT 6.0 mils
  - k. Electric vehicle charger legends shall be as detailed on the drawings. Color: Green background with white symbols and border – DFT 6.0 mils

- G. Allow 48 hours minimum curing time for paint before allowing traffic on surfaces. Clean up thoroughly including all protective tape, spilled paint, and debris. All parking area marking and painting to be protected by appropriate traffic barriers, lighted if necessary, so located as to prohibit parking and traffic until traffic lines are completed and properly dry.

### 3.9 SELF-ADHERING WATERPROOF MEMBRANE

- A. Surface Protection: Existing pavement surface must be cleaned of all loose dirt and debris and be dry. Cracks wider than 3/8-inch should be filled with suitable crack filler. Severally spalled or other distressed areas must be repaired according to this specification. Note: Commercial crack filler expands under the heat of any overlay and therefore the crack should be filled level or just below the existing pavement surface.
- B. Primer: (Surface shall be primed as follows):
- 1. Primer must be used on all milled surfaces. The liquid adhesive shall be placed on the surface, at a minimum rate of 250 square feet per gallon on milled surfaces.
  - 2. The primer must be completely dry prior to application of the membrane.
  - 3. Primer may be applied using brushes, rollers or by spraying at the prescribed rate of application. Never apply primer to wet or frozen surfaces.
  - 4. Areas primed and not covered with membrane within 24 hours should be re-primed. Smoothness and porosity of existing asphalt surface may affect coverage rate. Do not apply liquid adhesive at heavier rates than recommended,. Excessive material build-up will delay drying and membrane application.

- C. Temperature: The surface temperature should be 45 degrees F. and above when installing self-adhering waterproof membrane. Storage temperature should not exceed 125 degrees F.
- D. Installation:
  - 1. Center the roll over the joint or crack to be treated with the release paper attached. Allow for a material overrun of 4 to 6 inches beyond each end of the crack to ensure a waterproof seal. Cut the membrane with utility knife. Install the self-adhering membrane by removing release paper.
  - 2. Material should be laid smooth and adhere well to the existing pavement by rolling the membrane with a pickup truck or pneumatic roller. A stiff broom can also be used to aid adhesion.
- E. Tack Coat: A standard NYSDOT approved tack coat is applied over the self-adhering membrane and the remaining portion of the surface before placing the hot mix asphalt layer as specified.

### 3.10 SPEED BUMP

- A. Assemble as recommended by the manufacturer and install on site in locations as directed by the Architect and or District.

### 3.11 HOT POUR CRACK SEALING AND FILLING

- A. The crack must be free from moisture, dust, and loose aggregate. Routing or wire brushing are preferred methods followed by a compressed air heat lance immediately prior to sealing. The substrate and air temperature must be above 45°F.
- B. Shall be melted in direct fired or oil jacketed melters. Material should reach recommended pouring temperature of 350-400°F. Fresh material may be added as sealant is used.
- C. Apply heated crack filler using either a pump and wand system or a pour pot. For best results the sealant depth to width ratio should not exceed 2 to 1 (i.e. 2-inches deep to 1-inch wide). The cooled sealant height should not exceed 1/8" above surrounding pavement. Using a sealing shoe or squeegee, band the material 2 to 3 inches wide over the crack.

### 3.12 CLEAN UP

During the contract, and at intervals as directed by the Architect, and as asphalt paving is completed, clear the site of extraneous fabric, gravel, asphalt and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 321201

## SECTION 321301 - SITE CONCRETE WORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of site concrete work is shown on the drawings and includes formwork, reinforcement, accessories, cast in place concrete, installation of embedded items, mix designs, finishing, curing, sealing, testing and acceptance requirements for concrete.
- B. Site Concrete work includes, but is not limited to, the following:
  - 1. Concrete walks, pads, and ramps
  - 2. Concrete curbs and stairs
  - 3. Concrete curb ramps with detectable warning system
  - 4. Exterior anchoring cement non-shrink grout
  - 5. Concrete scheduling April 1 to October 15
  - 6. Clean up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 312201 - Site Earthwork
- B. Section 323000 Series - Site Improvements for Hand Railings and Traffic Signs
- C. Section 334001 - Storm Drainage

#### 1.3 REFERENCES

- A. American Concrete Institute (ACI), latest editions:
  - 1. 301-16 – Specification for Structural Concrete
  - 2. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
  - 3. 305R-20 – Guide to Hot Weather Concreting
  - 4. 306R-16 – Guide to Cold Weather Concreting
  - 5. 311 – Recommend Practices for Concrete Inspection
  - 6. 315 - Details and Detailing Concrete Reinforcement
  - 7. 318-19 - Building Code Requirements for Structural Concrete
  - 8. 347 – Guide to Formwork for Concrete
- B. Portland Cement Association (PCA). “Design and Control of Concrete Mixtures”, latest edition.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement

2. ASTM C31 - Standard Practice for Making and Curing Test Specimens in the Field
  3. ASTM C33 - Concrete Aggregate
  4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
  5. ASTM C94 - Ready-Mixed Concrete
  6. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars
  7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete
  8. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)
  9. ASTM C150 - Portland Cement
  10. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
  11. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method
  12. ASTM C260 - Air Entraining Admixtures for Concrete
  13. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
  14. ASTM C595 - Blended Hydraulic Cements
- D. Concrete Reinforcing Steel Institute (CRCI)\_Manual of Standard Practices
- E. New York State Building Code, latest edition
- F. New York State Department of Transportation (NYSDOT) Standard Specifications

#### 1.4 SUBMITTALS:

- A. Steel Reinforcement Shop Drawings that detail fabrication, bending, and placement. Comply with CRSI – Manual of Standard Practice showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement, mechanical connections, tie spacing, hoop spacing required for:
1. Stairs
  2. Curbs
- B. Manufacturers Product Data (MPD) and Samples where indicated are required for the following:
1. Expansion Joint and Sealant (Vertical and Horizontal): MPD and Color Samples
  2. Water Based Curing and Sealing Compound
  3. Water Based Penetrating Sealing Compound
  4. Concrete Control System for Type 1L Cement mix
  5. Slip Dowel System
  6. Fiber Reinforcement: (Curbs Only)
  7. Cold and Hot Weather Admixture
  8. Air Entrainment
  9. Detectable Warning System
  10. Exterior Anchoring Cement Non-Shrink Grout
  11. High Strength Anchoring Epoxy System

- C. Submit proposed 4,500 psi and 5,000 psi concrete mix design(s) and test data in accordance with ACI 301 to the Architect for review prior to commencement of the work.
  - 1. Indicate the locations and elements for which the mix will be used.
  - 2. Include in the concrete mix designs all required or proposed admixtures necessary to facilitate the installation of the concrete by the means and methods selected by Contractor for this project.
- D. Mill test certificates and/or test reports for cement indicating compliance with these specifications.
- E. Qualification Data: For Concrete Manufacturer.
- F. Welding Certifications
- G. Formal Letter from Concrete Contractor and/or Concrete Manufacturer with recommendations of materials to be used to maintain and remove ice / snow from newly installed concrete surfaces. The letter should also reference the potential damage of concrete surfaces from the use of de-icing chemicals and rock salt, by the Owner, during the first (1) year of concrete curing, from the date of placement.

#### 1.5 QUALITY ASSURANCE

- A. Concrete Manufacturer Qualifications: Company experienced in manufacturing ready-mix concrete products and that complies with ASTM C 94 and ASTM C 685 requirements for production facilities and equipment.
  - 1. Batch tickets are required to be provided for each batch of concrete produced and delivered to the project site.
- B. Concrete Testing Services: The Owner shall employ an acceptable independent testing laboratory to perform materials evaluation, testing of concrete mixes, and quality control testing. Coordinate day-to-day scheduling with the testing agency. Field technician shall be ACI Certified Grade 1 Field Technician.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4 "Structural Welding Code – Reinforcing Steel"
- D. Construct and erect concrete formwork in accordance with ACI 301 and 347.
- E. Perform concrete reinforcing work in accordance with ACI 301.
- F. Perform cast-in-place concrete work in accordance with ACI 301.
- G. Conform to current New York State Building Code.
- H. Field quality control tests are specified in Part 3 - Execution.

#### 1.6 JOB CONDITIONS



- A. Job conditions in Section 312201 apply. Provide ample and skilled manpower for concrete installation which is a recognized time sensitive procedure.
- B. All concrete work shall conform to American Concrete Institute (ACI) 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete".
- C. Use of ASTM C595 Type 1L Cement (PLC), within the submitted concrete mix design, supplied by the Ready-Mix Producers and to be utilized by the Concrete Installer for site scope items shall require verified written communication and collaboration between the Ready-Mix Producers and the Concrete Installer on the setting time, slump, air content, finishability, and pumpability of the supplied concrete. The Concrete Installer shall be fully aware of all limitations of this type concrete mix to receive a tooled / troweled / broomed finish, as shown on the plans and as specified. The Concrete Installer is responsible for providing the appropriate knowledge, expertise, manpower, and equipment necessary to ensure a clean, durable, well finished concrete product that will resist any potential delamination or finishing failures, which will need to be fully removed and replaced at no additional cost to the Owner.
- D. Do not install concrete work when the temperature of the outside air is below 50 degrees F. and falling unless suitable means acceptable to the Architect are provided to protect work from cold and frost and ensure that mortar and concrete will cure without freezing as indicated in "Cold Weather Concreting" below, including temporary heat and covers.
- E. Cold Weather Concreting: Provide non-chloride accelerating water reducing admixture in site concrete work placed at ambient air temperatures below 50 degrees F. (10 degrees C.). Comply with International Masonry Industry All-Weather Council cold weather construction and protecting recommendations and American Concrete Institute 306R-10 "Guide to Cold Weather Concreting."
- F. Hot Weather: Provide water reducing retarding admixture in site concrete work placed at ambient air temperatures above 80° F. Comply with American Concrete Institute 305R-20 "Guide to Hot Weather Concreting."
- G. Construction Review: Notify the Architect/Geotechnical Engineer when stairs, retaining walls, foundations, walks, ramps, curbs, and pads are formed and ready to receive concrete. Radius form layout and score patterns shall be inspected and approved by the Architect.
- H. Schedule: Unless otherwise directed in writing by the Architect, construct site concrete work from April 1 to October 15. This permits a minimum 30-day dry curing period prior to possible application of deicing chemicals and rock salt by the Owner.

#### 1.7 ADA REQUIREMENTS

- A. GENERAL: Concrete work shall comply with the Americans with Disabilities Act as described in the 2010 ADA Standards issued by the Department of Justice (DOJ) and the Department of Transportation (DOT) or latest edition, shall be used.
- B. Curb ramp and concrete walk surfaces shall meet the following tolerances:

1. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes.
2. Thresholds at doorways shall not exceed 3/4" in height for exterior sliding doors or 1/2" for other types of doors. Raised thresholds and floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2.
3. Detectable warning system shall cast in place for the safety and convenience of the visually impaired. Contractor shall have a minimum of three (3) years experience with materials and installation.

## 1.8 CONCRETE FIELD MOCKUP(S)

### A. CONCRETE FLAT WORK (using Type 1L Concrete):

1. Prior to installation of concrete flatwork using Type 1L concrete, erect a 5' x 5' minimum sample panels in place to further verify finishing time, slump, and setting time.
2. Construct at least two (2) weeks before start of other concrete work to allow concrete to set up before observation.
3. Mockup shall demonstrate each forming and finishing condition required on Project using materials, workmanship, joint treatment, curing method, and finishing techniques to be used throughout the project.
4. Retain samples of cement and aggregates used in mockup for comparison with materials used in remaining work.
5. When Architect determines that mockup does not meet requirements, demolish and remove it from the site and cast another until mockup is accepted.
6. Keep accepted mockup undisturbed during construction as a standard for judging completed work.
7. Demolish accepted mockup and dispose offsite only when directed by the Architect.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS AND ACCESSORIES

- A. Forms: Either steel or wood, exterior type softwood, PS1, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects, extending the full depth of concrete. Concrete walls which require radius form work shall be set with flexible forms, conforming to the shapes and dimensions as indicated.
- B. Lumber: PS 20.
- C. Form Ties: Snap-off, metal type of fixed length, cone type.
  1. Ties shall be left in place and equipped with swaged washers or other approved devices to prevent seepage of moisture along the tie.
  2. Depth of Breakback: Minimum one (1") inch.

3. Unless otherwise noted, provide form ties, which will not leave holes larger than one (1") inch diameter in concrete surface.
- D. Dovetail Anchor Slot: Galvanized steel, form filled, release tape sealed slots; bend tab anchors.

## 2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, plain finish, free of rust and/or oxidation. Reinforcing bars shall be bundled and tagged with grades and suitable identification markings, shall be waterproof, and shall not be removed until steel is placed.
- B. Steel Welded Wire Reinforcement ASTM A185, plain type:
1. Flat Sheets
  2. Mesh size: 6 x 6 (standard W1.4 x W1.4, heavy duty W2.1 x W2.1)
  3. Free of rust and/or oxidation
- C. Reinforcement Accessories:
1. Tie Wire: FS QQ- W-461 G, annealed steel, back, 16-gage minimum.
  2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. They shall provide sufficient supports at close enough spacing so that the steel will carry the weight of the workmen and the fresh concrete without deformation from its specified location.
- D. Fabricate concrete reinforcing in accordance with ACI 315 and CRSI's Manual of Standard Practice.
- E. Slip Dowels: Shall be a slip dowel system comprised of a round dowel sleeve and corresponding base. Standard of quality: shall be Speed Dowel as distributed by A.H. Harris, (860) 216-9500 or Architect approved equal.

## 2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials or the same type, brand, and source throughout the project:
1. Portland Cement: ASTM C 150, Type I/II.
  2. Fly Ash: ASTM C 618, Class F or C, with loss on ignition less than 6%.
  3. Slag Cement: ASTM C 989, Grade 100 or 120.
  4. Blended Hydraulic Cement\*: ASTM C 595 Type 1L.

\*Use of Blended Hydraulic Cement (Type 1L) requires additional project requirements prior to approval / use within this specification.

- B. Aggregates per (ASTM C33):
1. Fine aggregates: clean, sharp, natural sand.

2. Coarse Aggregates: hard, sharp, angular, strong, clean, 3/4" maximum size stone meeting the requirements of New York State Department of Transportation Specification 703.02.
- C. Water: Clean (not detrimental to concrete) and potable (ASTM C 94).

## 2.4 ADMIXTURES

- A. Calcium Chloride in concrete is prohibited.
- B. Air Entrainment Admixture: ASTM C260, Darex AEA ED or Architect approved equal.
- C. Water Reducing Admixture: ASTM C494, Type A; not containing more chloride ions than are present in municipal drinking water.
- D. High Range Water Reducing Admixture: ASTM C494, Type F or G; not containing more chloride ions than are present in municipal drinking water.
- E. Cold Weather Accelerating Admixture: (Ambient temperature below 50°F.) Non-chloride water reducing accelerating admixture, ASTM C494, Type C, PolarSet as manufactured by WR Grace & Co. or Architect approved equal. Mix at rates recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.
- F. Hot Weather Water Reducing and Retarding Admixture: (Ambient temperature above 80° F.) Shall be Daratard series admixture, ASTM C494, Type D, as manufactured by WR Grace & Co. or Architect approved equal. Mix at a rate recommended by the manufacturer. No reduction in compression rating of the concrete is permitted.

## 2.5 RELATED MATERIALS

- A. Expansion Joints:
  1. For Radius Applications: Expansion joint filler shall be polyethylene closed cell backing with peel off strip, X-Foam as manufactured by W.R. Meadows or Architect approved equal.
  2. For Straight Applications: Expansion joint filler shall be fiber expansion joint with peel off snap-cap, as manufactured by W.R. Meadows or Architect approved equal.
- B. Caulking for flat slabs shall be one-part elastomeric self-leveling polyurethane gray sealant Pourthane SL or Architect approved equal. Caulking for vertical surfaces shall be one component elastomeric gun grade polyurethane sealant Pourthane NS, color as selected by the Owner to match wall stain or Architect approved equal.
- C. Fiber Reinforcement for Concrete Curbs: Shall be Grace Fibers 3/4" long, fibrillated polypropylene fibers as manufactured by WR Grace & Co. or Architect approved equal. Add fibers to concrete at the rate of 2.0 lbs/c.y. and as recommended by the manufacturer.

## 2.6 COMPOUNDS, HARDENERS, AND SEALERS for NON-TYPE 1L CEMENT MIXES

- A. Water Based, Acrylic, Curing and Sealing Compound: ASTM C309, Type 1, Class A and B, clear or translucent. Standard of quality shall be VOCOMP-20 as manufactured by W.R. Meadows or Architect approved equal.
- B. Water Based Penetrating Sealer: clear, penetrating, breathable, VOC-compliant, solvent free surface treatment for use on concrete to protect against water and chloride intrusion. Standard of quality shall be Protectosil 300 S as manufactured by Evonik Corporation or Architect approved equal.

## 2.7 COMPOUNDS, HARDENERS, AND SEALERS for TYPE 1L CEMENT MIXES

- A. Curing, Sealing, and Protection System for Type 1L Cement Mix: Clear, penetrating, reactive, VOC-compliant system consisting of combined evaporation reducer, finish aid, curative, fixative, densifier, sealer agents to promote proper cure and produce mechanically and chemically densified power troweled concrete surfaces. Standard of quality shall be Emerald Concrete Control Series (Emerald Control, IceCore, and Emerald X) as manufactured by Green Umbrella Systems ([greenumbrellasystems.com](http://greenumbrellasystems.com)) or Architect approved equal.

## 2.8 CONCRETE MIX - GENERAL

- A. Prepare design mixes for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both. Concrete mix designs shall conform to the requirements of ACI 301.
- B. Cementitious Materials:
  - 1. Use cementitious materials of the same brand and type and from the same manufacturing plant as those used in establishing the approved concrete mix design.
  - 2. Fly ash or slag cement may be used as needed to reduce the total amount of Portland cement, which would otherwise be used, by not more than 15 percent. Notify concrete finishers of concrete material containing fly ash or slag cement.
    - a. Exception: Do not use fly ash or slag cement in any concrete mixtures for exterior concrete / slabs that will have moisture sensitive coating or finishes applied to the concrete.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Use aggregates from the same source and of the same size range as those used in the approved concrete mix design.

- E. Admixtures: Use admixtures of the same brand and type as those used in the approved concrete mix design. Use admixtures according to the manufacturer's instructions.
- F. Mix and deliver ready-mix concrete in accordance with ASTM C94.
  - 1. Concrete must achieve stated minimum compressive strength at 28 days.
  - 2. Concrete containing fly ash or slag cement must achieve stated minimum compressive strength at 56 days.

## 2.9 CONCRETE MIX – WALKS, SLABS, AND CURBS

- A. Concrete Mix:
  - 1. Compressive Strength (Minimum at 28 days): 4,500 psi
  - 2. Slump (Maximum): 4 inches +/- 1"
  - 3. Air Entrainment: 6 – 8.5% +/- 1.5%
  - 4. Flexural Strength (ASTM C78): 650 psi at 28 days.
- B. Use water-reducing admixture in all concrete.
- C. Water/Cement Ratio: Maximum 0.45 for 4,500 psi concrete.
- D. Maximum Size of Coarse Aggregate:
  - 1. General Work: Per ACI 301, 3/4" maximum.
- E. Select admixture proportions for normal weight concrete in accordance with ACI 301.
- F. Add air-entraining agent to concrete mix for all concrete work exposed to exterior.

## 2.10 CONCRETE MIX – STAIRS

- A. Concrete Mix:
  - 1. Compressive Strength (Minimum at 28 days): 5,000 psi
  - 2. Slump (Maximum): 4 inches +/- 1"
  - 3. Air Entrainment: 6 – 8.5% +/- 1.5%
  - 4. Flexural Strength (ASTM C78): 650 psi at 28 days.
- B. Use water-reducing admixture in all concrete.
- C. Water/Cement Ratio: Maximum 0.40 for 5,000 psi concrete.
- D. Maximum Size of Coarse Aggregate:
  - 1. General Work: Per ACI 301, 3/4" maximum.
- E. Select admixture proportions for normal weight concrete in accordance with ACI 301.



- F. Add air-entraining agent to concrete mix for all concrete work exposed to exterior.

## 2.11 MIXING WATER CONTROL

- A. The quantity of mixing water used in the concrete mix shall be determined by the Contractor, except that the Architect/Geotechnical Engineer may direct that such quantity of water be reduced if the slump of the concrete exceeds the specified slump. The Contractor's determination of the quantity of mixing water shall conform to the various limits on water/cement ration and slump specified. Concrete consistency shall be uniform from batch to batch.
- B. During the work, the batch plant will make quantitative measured moisture determinations of the aggregates utilized in each batch. Aggregate weights and batch water requirements shall be adjusted accordingly for measured aggregate moisture content.
- C. When concrete is transported in units approved for mixing, the addition of not more than 10% of the total design water will be permitted at the job site to obtain initial slump.
  - 1. Any addition of water shall be followed by mixing of at least 30 revolutions in the mixing speed range.
  - 2. No more than two additions of water at the point of deposition before discharge shall be allowed.
  - 3. No retempering of the concrete will be permitted. Retempering is defined as the addition of water after the mix has attained its desired initial slump.

## 2.12 DETECTABLE WARNING SYSTEM

- A. Cast in place vitrified polymer composite (VPC) detectable/tactile warning tiles shall be an epoxy polymer composition with aluminum oxide particles in the truncated domes. Standard of quality shall be Armor-Tile 24" x 36" cast-in-Place Inline Dome Tactile Tile (ADA-C-2436) as manufactured by Engineered Plastics, Inc. 800-682-2525 or Architect approved equal.
- B. Color shall be colonial red (Federal No. 20109) or Architect approved equal.
- C. Guarantee period shall be five (5) years from substantial completion including defective work, breakage, deformation, heave, and loosening tiles.

## 2.13 EXTERIOR ANCHORING CEMENT (NON-SHRINK GROUT)

- A. For Steel Posts, Fencing and Other Non-Aluminum Elements: Shall be an exterior grade anchoring cement (non-shrink grout) with a min. compressive strength (ASTM C-109) of 7,200 psi at 28 days. Standard of quality shall be Super Por-Rok as manufactured by CGM, Inc., [www.cgmbuildingproducts.com](http://www.cgmbuildingproducts.com), or Architect approved equal.
- B. For Aluminum Posts and Elements: Shall be an exterior grade anchoring cement (non-shrink grout) with a min. compressive strength (ASTM C-109) of 7,200 psi at 28 days.

Standard of quality shall be Por-Rok as manufactured by CGM, Inc., [www.cgmbuildingproducts.com](http://www.cgmbuildingproducts.com), or Architect approved equal.

## 2.14 HIGH STRENGTH ANCHORING EPOXY SYSTEM

- A. A two-component vinylester adhesive anchoring system. The system includes injection adhesive in plastic cartridges, mixing nozzles, dispensing tools and hole cleaning equipment.
- B. Designed for bonding threaded rod and reinforcing bar elements into drilled holes in concrete and masonry base materials.
- C. Standard of quality shall be AC100+ GOLD Vinylester Injection Adhesive Anchoring System as distributed by A.H. Harris, (315) 414-0340, or Architect approved equal.

## PART 3 - EXECUTION

### 3.1 CONCRETE WALKS, PADS, AND RAMPS

- A. Surface Preparation: Remove loose material from the compacted subgrade surface immediately before placing concrete. Remove any standing water, mud, debris, frost, snow, ice from surfaces upon or against which concrete is to be placed.
- B. Proof-roll prepared subgrade surface to check for unstable areas and the need for additional compaction. Do not begin concrete pour until such conditions have been corrected, subgrade is compacted to 95% and ready to receive concrete.
- C. Form Construction: Construct to required size and shape. Brace and secure to maintain alignment, elevation and position. Check completed formwork for grade and alignment, prior to installing concrete. Clean forms as needed to removed foreign matter.
- D. Install welded wire mesh on concrete brick or mesh chairs to proper level in maximum lengths possible. Offset end laps in both directions. Splice laps with tie wire. Lifting mesh after concrete pouring is not acceptable.
- E. Prepare concrete mixture including the following:
  - a. Add hot weather or cold weather admixture to accommodate field weather conditions.
- F. Concrete Testing: Will be performed as described in Part 3, "Field Quality Control" of this specification section.
- G. Conveying Concrete:
  - 1. Convey concrete by means that will prevent segregation and loss of mortar from the mix.



2. Provide adequate manpower and equipment in the form of buckets, buggies, chutes, conveyors or other approved means to assure continuous operation.
3. Convey concrete so that no equipment with aluminum parts comes in contact with fresh concrete.

H. Concrete Placement:

1. Do not place concrete until subgrade and forms have been checked for line and grade.
2. Moisten granular base course as required to provide a uniform dampened condition at the time concrete is placed.
3. Do not place concrete around manholes or other structures until they have been brought to the required finish grade, alignment, and expansion joints have been installed.

I. Spread concrete as soon as it is deposited on the granular base course, using methods which prevent segregation of the mix, and with as little rehandling as possible. Consolidate concrete along the face of forms. Consolidate with care to prevent dislocation of mesh, reinforcing and joint materials.

J. Concrete Joints:

1. Construct expansion and contraction joints as detailed and as shown on plans. Concrete joints that do not follow the pattern(s) shown on the plans and/or changes that have been approved by the Architect will be removed and replaced at no additional cost to the Owner.
2. When the walkway is abutting existing walks, place transverse joints to align with previously placed joints, unless otherwise shown.
3. Contraction Joints: Approximately 5'-0" on center. Break walk into individual slabs of not more than twenty-five (25 sf) square feet with jointing tool, round edges. Saw cut scoring pattern (contraction joints) to depth shown on details for each type of concrete work with new, sharp concrete sawblade one day (24 hours) after the pour. Joint cuts to be clean, sharp, uniformly made cuts to achieve scoring pattern as shown and detailed.
4. Expansion Joints: Provide where abutting building(s), columns, structures, concrete paving and curbs, catch basins, manholes, inlets, walks, walls, other fixed objects and as directed by the Architect.
5. Locate expansion joints at thirty feet on center (30' o.c.) for each walkway lane, unless otherwise shown. Provide slip dowels as detailed and specified.
6. Locate expansion joints with slip dowels at all flush building access points, whether specifically shown on drawings or not.
7. Extend joint fillers full width and depth of the joint, flush with finished pavement grade, and not less than 1/4" or more than 1/2" below the finished pavement surface. Joint surfaces shall be clean and dry prior to installation of sealant as per manufacturer's recommendations. Remove excess sealant on surfaces adjacent to joint.

K. Concrete Finishing:

1. Perform concrete finishing using machine or hand methods as required.

2. After striking off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.
3. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous, smooth finish.
4. Work edges of slabs and joints with a 1/8" radius edging tool, two (2") wide, unless otherwise shown.
5. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows.
6. Broom finish, by drawing a medium hair broom across the concrete surface as detailed. Repeat operation when required to provide a medium texture acceptable to the Architect.
7. For handicap curb ramps, tool grooves along sloping surfaces in line with drainage flow as detailed.

L. Concrete Curing and Sealing Non-Type 1L Cement Mixes:

1. Refer to schedule note in 1.6 Job Conditions above.
2. Immediately after placement, protect concrete from premature drying.
3. Remove all dirt, dust, oil, grease, asphalt, vegetation, grass, and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry.
4. Stir curing compound thoroughly before using.
5. Apply a continuous, uniform film by solvent-resistant low-pressure spray only, short-nap roller or lamb's wool applicator. For best results, use a canister curing compound sprayer. Use spray tip number 8004 or equivalent for water-based or waterborne products.
6. For curing, coat evenly and uniformly as soon as possible after final finishing.
7. Apply penetrating sealer minimum thirty (30) days after application of curing compound when all construction is completed and structure is ready for occupancy / use, prior to any application of de-icing chemicals. Following manufacturer's recommendations for application over concrete including removing any remaining curing products.
8. When soil contamination occurs, notify the Architect immediately in writing. Remove contaminated soils and legally dispose of, provide soil test(s), replace soil, plantings and lawns at no additional cost to the Owner.

M. Concrete Curing and Sealing Type 1L Cement Mixes:

1. Refer to schedule note in 1.6 Job Conditions above.
2. Follow Emerald Concrete Control Series Application Guide. Do NOT skip any required step as directed. Do NOT reuse sprayers between steps.
2. Immediately after screed apply Emerald Control at 800 sf per gallon with sprayer, continue finishing as detailed and specified.
3. Once slab is walkable and finishing is complete install IceCore at a rate of 500 sf per gallon.
4. Wait 48 hours after pour, once slab is dry and clean install Emerald X at a rate of 800 sf per gallon. Keep concrete clean of ANY traffic for 24 hours minimum.

5. When soil contamination occurs, notify the Architect immediately in writing. Remove contaminated soils and legally dispose of, provide soil test(s), replace soil, plantings and lawns at no additional cost to the Owner.

N. Detectable Warning System:

1. Pour and float concrete, set tile by tamping grid pattern down into the concrete until all air voids are removed with a rubber mallet.
2. Place two cinder blocks or 25 lbs weight on the tile to prevent floating.
3. Create an edge around the perimeter of the tile using a 3/8" radius edging tool then float the concrete around the tile's perimeter using a steel trowel.
4. After concrete has cured, remove protective plastic wrap.
5. Protect tiles against damage during construction and clean tiles as recommended by the manufacturer.

### 3.2 CONCRETE CURB

- A. General: Concrete Curb shall meet the requirements specified for concrete in this Section, Item 3.1 above. Install forms true to line and grades given on plan. Provide permanent in place expansion joints using pre-molded expansion joint filler thirty feet (30' o.c.) on center, maximum. Install reinforcing bars as detailed. Remove forms in twenty-four (24) hours. Saw cut the contraction joints approximately 10' on center 1-1/2" deep with a new sharp concrete saw blade the next day after the pour along top and both faces of curb. Note: When the saw-cutting is not performed as described, an extended written guarantee or credit for defective work will be required by the Architect.
- B. Finishing: Remove ties and patch tie holes, including those below grade. Remove fins and patch minor voids. Chip out major stone pockets and repair. Rub surface smooth with carborundum brick dipped in neat cement grout to fill pin holes. Trowelled on cement plaster is prohibited. After drying, rub off excess cement dust with burlap.
- C. Curing: See 3.1, above.
- D. Slip-formed (machine formed) curbs are acceptable when installed in accordance with NYSDOT 609-3.04-B using Type "J" concrete and mixing in fiber mesh as specified. Expansion and contraction joints are still required as detailed including slip dowels at expansion joints.

### 3.3 CONCRETE STAIRS

- A. General: Concrete stairs shall meet the requirements specified for concrete in this Section, Item 3.1, except as noted below.
- B. Verify that lines, levels, locations and form dimensions comply with drawings and submittals.
- C. Design, erect, support, brace, and maintain formwork to support applied vertical and lateral loads. Construct formwork to provide correct size, alignment, elevation, pitch on tread, and position of concrete work.

- D. Design and erect formwork to permit removal without damage to cast-in-place concrete surfaces and adjacent materials during stripping.
- E. Install, align, and level forms. Support and brace forms in place.
- F. Coat form surfaces with form release agent. Clean forms after each use and coat with form release agent as necessary to assure separation from concrete without damage. Apply before placing reinforcing steel, anchoring devices, and embedded items.
- G. Provide reinforcing bars adequately supported and secured to prevent displacement.
- H. Placement of concrete shall be in layers not to exceed 18 inches without consolidation with the aid of mechanical vibrating equipment. To achieve even and dense surfaces, free of aggregate pockets or honeycomb, vibration shall be supplemented by spading by hand in the corners and angles of forms and along surface while concrete is plastic under the vibratory action. Placement of concrete shall conform to recommendations of ACI 309 "Recommended Practice for Consolidation of Concrete".
- I. Install, set, and build-in items furnished by other trades. Provide adequate notification for installation of necessary items. Coordinate with reinforcing, safety railings and hand railings.
- J. Remove ties and patch tie holes, including those below grade. Remove fins and patch minor voids. Chip out major stone pockets and repair. Rub surface smooth with carborundum brick dipped in neat cement grout to fill pin holes. Trowelled on cement plaster is prohibited. After drying, rub off all excess cement dust with burlap.
- K. Medium broom finish stair treads with strokes perpendicular to flow of pedestrian traffic, similar to walks. Other exposed concrete surfaces shall be rub finished similar to concrete curb.
- L. Cure and seal as specified in this section, item 3.1 above.
- M. Strip Forms and Bracing: Three (3) days minimum before stripping. It is the Contractor's responsibility to determine the time at which forms may be removed without damaging the stairs and only after concrete has gained sufficient strength to carry its own weight and imposed loads.

### 3.4 FOOTINGS, BASES, AND FOUNDATIONS

- A. Footings, Bases, Foundations: Locate and provide where shown on drawings and as detailed.

### 3.5 INTERRUPTION OF CONCRETING

- A. Should placing concrete be suspended or unavoidably interrupted, provide keyways and bulkheads to prevent feather-edging when work is resumed. Roughen horizontal surface for bond.

### 3.6 REPAIR AND PROTECTION FOR CONCRETE WORK

- A. Cut out and replace defective concrete work which has blisters, cracking, crazing, curling, discoloration, dusting, efflorescence, low spots, pop outs, scaling or mortar flaking, spalling, settling, or heaving as defined by Portland Cement Association 2001, "Concrete Slab Surface Defects" and as directed by the Architect.
- B. Modify or replace concrete not conforming to the required lines, details, elevations and specifications as directed by the Architect.
- C. Protect the work from damage until acceptance of the work. Exclude traffic from concrete work for at least fourteen (14) days after placement. When construction traffic is permitted, maintain concrete as clean as possible by removing surface stains and spillage of materials as they occur.

### 3.7 ANCHORING RAILINGS AND POSTS INTO CONCRETE

- A. Aluminum posts **must** be coated or treated with a good sealer or paint prior to anchoring.
- B. Drill the hole as detailed. Blow out all dust and loose particles.
- C. Fill the hole with water. Scrub the sides and bottom of the hole and with a stiff wire brush such as a bottlebrush. This is important.
- D. Remove excess water with rag or other absorbent materials. Leave the hole clean and uniformly damp.
- E. Mix the anchoring cement in a clean container to flowable consistency based on the following formula. For best results, measure accurately. The correct amount of water is as follows:

2.3 oz per lb  
11.5 oz for 5 lbs  
115 oz for 50 lbs  
7 quarts for 100 lbs

Measure the amount of anchoring cement and water to be mixed. Add the measured amount of water to the appropriate amount of cement and mix until the desired consistency is achieved. (NEVER USE MORE WATER THAN PRESCRIBED). This will reduce the ultimate strength, increase the possibility of volume instability and may cause the product to become soft and less durable.)

- F. Fill the hole with the plastic cement first, and then tamp the bolt, post or rod with a twisting motion into place. If the material becomes too fluid during the tamping process and sags out of place, let it stand for a few minutes and it will stiffen. Smooth out the surface around the bolt with spatula or trowel.
- G. Let the cement harden for at least 60 minutes. For heavy equipment, allow 4 hours prior to use or loading.

### 3.8 ANCHORING BOLTS, DOWELS, AND REBAR INTO CONCRETE

- A. Anchor Hole Preparation: Prepare all anchor holes prior to placement of anchoring epoxy. Hole diameter is typically 1/8" (3 mm) greater than the anchor diameter. Hole depth is typically nine times anchor diameter. Required minimum anchor hole depth is 6". Consult project specifications and details. Drill hole to proper diameter and depth and blow all dust from the bottom of the hole, brush and blow (4x) repeatedly to remove all dust and debris. The anchor hole must be clean and free of standing water prior to placement of material.
- B. Application: Use only professional caulking guns. Remove plastic caps and plugs from cartridge. Save for closing cartridge. Attach mixing nozzle to cartridge. Discard small amounts of gunned products until uniform color is achieved. Mixing nozzle will harden in approximately 20 min. if not in use.
- C. Hardened nozzles must be discarded. Dispense the epoxy at the bottom of the hole while withdrawing nozzle. Dispense epoxy (typically filling 5/8 of hole) so that once threaded rod or rebar is inserted, the hole is completely full. Insert threaded rod or rebar to the bottom of the hole while turning clockwise. Promptly remove any excess material. Leave anchor undisturbed for 6 hours (at 77°F /25°C), or longer for colder temperatures. Load can be applied 8 hours at 77°F (25°C).

### 3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed by ACI certified technicians; Grade 1. Certificates shall be submitted to the Architect for people performing inspection and testing prior to the start of work.
- B. Field Inspection and testing shall be paid for as directed under 1.5 "Quality Assurance". Where retesting, additional inspection, lab tests or other professional services are required due to rejected work, any cost associated therewith will be solely at the Contractor's expense.
- C. The Contractor shall plan his operations to allow adequate time for all required testing and inspection.
- D. The Contractor shall provide facilities and equipment necessary to obtain and handle representative sample of materials to be tested.
- E. The testing laboratory shall be responsible to the Owner for the field control of all concrete and may reject batches because of high slump, uncontrolled air entrainment, delays or other conditions of non-compliance with these specifications.
- F. Sampling and Field testing will be performed during concrete placement per ASTM C31, C39, C143, C172 and C173.
- G. Five (5) Concrete Test Cylinders: Taken for every thirty (30) or less cubic yards of concrete placed are required or a fraction thereof;
  - 1. Two (2) Cylinders will be tested at 7 days; two (2) cylinders will be tested at 28 days and one (1) cylinder will be tested at 56 days.

- H. One (1) Additional Test Cylinder: Taken during cold weather concreting, to be cured on the job site under the same conditions as placed concrete it represents, is required.
- I. Air Content Test: Taken for each set of test cylinders taken, is required.
- J. One (1) Slump Test: Taken for each set of test cylinders taken is required.
- K. Test results will be reported to the General Contractor and Architect on same day tests are made. Emailed reports will follow to the Owner, Architect, and Landscape Architect. Email copies of laboratory test, evaluation reports for concrete materials and mix designs will be submitted.

### 3.10 CLEAN UP

During the contract and at intervals as directed by the Architect and as concrete work is completed, clear the site of gravel, concrete, appurtenances and debris. Leave the site in a clean, safe, well-drained, neat condition.

END OF SECTION 321301

## SECTION 323001 - TRAFFIC SIGNS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of traffic signs is shown on the drawings.
- B. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 SUBMITTALS:

- A. Provide shop drawings for each different type and size of sign listed in the Traffic Sign Schedule.
- B. Provide MPD for signposts, breakaway system, and sign plates.

#### 1.3 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. No work shall be fabricated until shop drawings for the work have been favorably reviewed by the Architect.
- C. Construction Review: Notify the Architect when locations for signs are coordinated to avoid underground utilities and marked in the field for review.
- D. Provide posts, bolts, splice bars, sign plates and build in coordination with work of other trades.

### PART 2 - PRODUCTS

#### 2.1 SIGNS

- A. Sign Plate:
  - 1. Sign Plate shall be aluminum sheets .090" (approximately 3/32") thick, with two coats of Dupont Imron spray semigloss paint.
  - 2. Letters, numbers, symbols, and arrows shall be engineering grade, (EG) reflective. Sign plates, letters and numbers shall meet the colors and regulations described in the "Manual of Uniform Traffic Control Devices", latest edition, as published by the State of New York Department of Transportation, Division of Traffic and Safety.
  - 3. The following Traffic Sign Schedule shall apply:



| SIGN WORDING                                | SIGN NO.               | SIZE                  | LETTER SIZE / COLORS                                              |
|---------------------------------------------|------------------------|-----------------------|-------------------------------------------------------------------|
| HC Reserved<br>Parking w/<br>Van Accessible | P4 - 6C<br>P3-8(NY)    | 12" x 18"<br>12" x 6" | 2" Green/White<br>Blue Background<br>2" Green/White<br>Background |
| Pedestrian<br>Crossing                      | *W5-1C<br>or<br>W6-E2C | 30" x 30"             | Yellow<br>background,<br>black legend                             |
| No Parking<br>Any Time                      | P1-1                   | 12" x 18"             | 3"C/Red on<br>White                                               |

4. Refer to Traffic Sign Schedule and/or sign details on drawings for sign wording, quantities, and other information.
5. Hardware shall be galvanized.
6. Standard of quality shall be as manufactured by Eastern Metal/USA-Sign, [www.usa-sign.com](http://www.usa-sign.com) or Architect approved equal.

B. Breakaway Signposts:

1. Shall be minimum 2.5 lbs. / ft high carbon new billet steel (SP-80) U-channel posts with predrilled 3/8" holes at 1" on center.
2. Crashworthy to NCHRP 350 criteria. Meeting FHWA (Federal Highway Administration) for small sign support applications.
3. Lap Splice U-channel Breakaway System shall be 3/8" x 3/4" x 5" and sized to post, bar color silver. Special manufacturer designed bolts for lap splice are required.
4. Hot dipped galvanized.
5. Standard of quality shall be "Rib-Bak" U-channel signposts as manufactured by NUCOR Steel Marion, Inc. [www.nucorhighway.com](http://www.nucorhighway.com) (800) 333-4011 or Architect approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALL SIGNS

- A. Erect signs plumb. Drive posts into firm ground or bolt to sleeve in pavement areas or concrete footings as detailed. Use driving caps to avoid deforming posts.
- B. Mount sign plates at heights detailed. Attach metal sign plates to steel posts securely with 1/4" galvanized allen head screws.

### 3.2 CLEAN UP

During the contract and at intervals as directed by the Architect and as traffic sign installation(s) are completed, clear the site of extraneous paint, fasteners, concrete, gravel, asphalt, and debris. Leave the site in a clean, safe, well draining, neat condition.

END OF SECTION 323001

## SECTION 329201 - SODDED LAWNS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of the lawn work is shown on the drawings. The lawn work limits equal the Contract Limit Line except as noted on the drawings. Non-paved, non-roofed areas within the Contract Limit Line shall receive four (4") inches settled depth of topsoil and lawn sod. Existing lawn areas that are not disturbed require no additional work. Lawn types as shown on the drawings are defined as follows:
  - 1. Lawn: Strip and stockpile 4" topsoil, mechanically screen, replace 4" topsoil, and sod.
- B. Lawn work includes, but is not limited to, the following:
  - 1. Placing and spreading stockpiled topsoil
  - 2. Importing, placing and spreading topsoil
  - 3. Sod bed preparation and placing
  - 4. Sodding lawns
  - 5. Mulching and fertilizing
  - 6. Maintenance: See watering, mowing, fertilizing, core aerating, weed control, grow in and other specific requirements.
  - 7. Clean Up
- C. Provide materials, labor, equipment, and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation (Topsoil Stripping)
- B. Section 312201 - Site Earthwork

#### 1.3 REFERENCES

- A. ASTM D4972 - Standard Test Method for pH of Soils
- B. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes
- C. ASTM D422 and D1140 - Standard Test Method for Particle Size Analysis of Soils
- D. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effect

- E. ASTM F1647 - Standard Test Method for Organic Material Content of Athletic Field Rootzone Mixes.
- F. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sportsfield Rootzone Mixes
- G. ASTM F2060 - Standard Guide for Maintaining Cool Season Turfgrasses on Athletic Fields
- H. National Turfgrass Federation, Inc.
- I. National Turfgrass Evaluation Program (NTEP).
- J. Cornell Universities: Sportsfield Management Guidelines
- K. Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.

#### 1.4 SUBMITTALS

- A. Furnish name of Landscape Contractor or Nurseryman to perform lawn work and a list of completed projects including contact information for each project demonstrating compliance with applicable qualification requirements outlined in 1.5 "Quality Assurance" of this specification section.
- B. Provide Material Certificates and MPD for:
  - 1. Sod species and source, location for sod producer
  - 2. Limestone
  - 3. Fertilizers
- C. Provide Topsoil Test Report (for Onsite and Imported Topsoil): Submit test results from Architect approved independent testing laboratory on their letterhead. Report shall:
  - 1. Certify soil texture, organic content, and particle size analysis.
  - 2. Chemical analysis testing nitrogen, phosphorus, potassium, calcium, magnesium, cation exchange capacity, base saturation percentages, micronutrients and acidity (pH).
  - 3. Provide timing and rates of soil additives, liming and fertilizers. (Materials and procedures regarding soil amendments and fertilizers specified in this section are approximate.) Adjust all soil amendments to comply with test results based on actual soil tests and as directed by the Architect at no additional cost to the Owner.
- D. Provide letter on Contractor's letterhead certifying that only topsoil from the above tested source was used on the project.
- E. Provide schedule for review and approval as outlined under "Sequence and Scheduling" of this specification section.

## 1.5 QUALITY ASSURANCE

- A. General Lawn Contractor: Work shall be contracted to a single, established Landscape Contracting or Nursery firm having sufficiently experienced crews, supervisor(s), specialized equipment, and an excellent record of performance on completed lawn and athletic field projects of comparable size, scope, and quality. Provide expert turfman to direct the work in the field on a regular, daily basis. The expert turfman shall be employed by the same company engaged in the installation of the lawn work for a minimum of five (5) years.
- B. Sod Standards: Comply with the Turfgrass Producers International: Guideline Specifications to Turfgrass Sodding, latest edition.
- C. Testing: If required by the Architect for poor lawn grow in, engage an Architect approved independent, qualified New York State testing service and turfgrass specialist to evaluate Contractor grow in practices and materials used. Pay for all testing/inspection services, materials, and manpower to correct lawn areas as approved by the Architect.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Sod:
  - 1. Cut, deliver, and install sod within a 24-hour period. Sod cutting and shipping shall be coordinated with the sod installers.
  - 2. Do not harvest or transport sod when moisture content may adversely affect sod survival.
  - 3. Protect sod from sun, wind, and dehydration prior to installation.
  - 4. Do not tear, stretch or drop sod during handling and installation.
  - 5. Store sod materials at site in an orderly manner at location(s) acceptable to the Architect.
- B. Fertilizer:
  - 1. Deliver fertilizer in the manufacturer's standard sized bags showing the weight, analysis, and manufacturer's name. Store all fertilizer under a waterproof cover or in a dry place as approved by the Architect.

## 1.7 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Lawn Work:
  - 1. Perform lawn work after planting, fine grading and other work affecting the ground surfaces in the lawn work areas has been completed satisfactorily.
  - 2. Where practical, the Owner will provide a connection to the water system such as, but not limited to, existing yard hydrants, building hose bibs, etc. If this source is insufficient, not available or practical to provide a source of sufficient

water to meet the requirements herein, the Contractor shall secure a water source sufficient to meet the water requirements herein such as, but not limited to, municipal hydrants, water truck, etc. at no additional cost to the Owner.

3. Contractor shall provide all watering equipment and appurtenances such as, but not limited to, meters, backflow preventer, labor, hoses, sprinklers, irrigation and watering equipment.
4. Calendar dates for sodding under "Sequence and Scheduling" of this specification section shall apply.
5. Place sod only when ground surface is free of mud, frost, snow and ice.
6. Protect newly sodded lawns from vehicles, vandalism, or trespass. Provide temporary fencing or barriers as required.

C. Construction Review:

1. Upon completion of topsoil spreading and sod preparation, notify Architect to review work.
2. The Architect may review fine graded areas by the Contractor to check for surface smoothness and general compliance with grading requirements. Fill or cut by hand raking or other acceptable means to achieve smooth, even well-draining lawn surfaces free of "bird baths" and breaks in grade as directed by the Architect at no additional expense to the Owner.
3. Review of any fine graded lawn areas by Architect shall not alleviate the Contractor of his responsibility for conforming to the required grades as shown on the drawings, nor be misconstrued as final acceptance of lawn work.

## 1.8 SEQUENCING AND SCHEDULING

A. Schedule: Prior to construction, provide a schedule which addresses the following lawn thresholds involving erosion control stabilization:

1. Sodding Installation: The Contractor may invoice for 50% of the approved schedule of value breakdown at the time of acceptable installation.
  - a. Unless otherwise directed in writing by the Architect, sod lawns from April 1 to May 15, and from August 15 to October 1. Sodding between May 16 and August 14 is not acceptable unless adequate water supply is available and applied to the turfgrass as required herein and approved by the Architect.
  - b. Proceed with and complete sodding as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
2. Substantial Completion: The Contractor may invoice for 25% of the approved schedule of value breakdown at the time of substantial completion as described in Part 3, "Standards For Substantial Completion Of Lawns" of this specification section. At this time, the Architect may issue the Notice of Termination to satisfy the NYS DEC stabilization requirements. The date of substantial completion is anticipated approximately 60 days after lawn installation presuming all Contractor maintenance operations have been vigorously performed.
3. Final Acceptance: The Contractor may invoice for the final 25% of the approved schedule of value breakdown at the time of final acceptance as described in Part

3, "Standards For Final Acceptance Of Lawns" of this specification section. The date of final acceptance is anticipated approximately 30 days after substantial completion presuming all Contractor maintenance operations have been vigorously performed.

4. Owner Maintenance: After final acceptance of the lawns, the Owner will maintain for 1 to 3 growing seasons to reach competitive maturity and beyond per ASTM F2060.

## PART 2 - PRODUCTS

### 2.1 TOPSOIL

- A. Source: Provide from off site, Architect approved source, when stripped, stockpiled and amended quantity is inadequate to provide four (4") inches settled depth of topsoil for all lawn areas at no additional cost to the Owner.

- B. Texture and Content: Provide topsoil conforming to the following:

1. Soil texture and content:

- a. Sandy loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material. Topsoil shall be entirely free of dense material, hardpan, clay, stones over 3/4" in diameter, sod, or any other objectionable foreign material, including but not limited to, glass, debris, toxins, hazardous wastes and chemicals (such as atrazine or muriatic acid within the past seven (7) years) that may be injurious to humans, animals and plant materials.

- b. Organic Matter: Containing not less than 5% or more than 10% organic matter in that portion of a sample passing a 1/4" sieve when determined by the wet combustion method on a sample dried at 105 degrees F.

2. pH Value: Containing a pH value within the range of 6.0 to 7.0 on that portion of the sample which passes a 1/4" sieve.
3. Soluble salt content: Not higher than 500 parts per million.
4. Sieve Analysis for general lawn work: Shall be screened or rock picked to meet the following gradation:

| Sieve Designation | % Passing                 |
|-------------------|---------------------------|
| 3/4"              | 100                       |
| 1/4"              | 97-100                    |
| No. 200           | 20-65 (of the 1/4" sieve) |

- C. No lawn shall be sodded on topsoil that has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. The Contractor shall assume full responsibility for any loss or damage to turfgrass sod, as indicated herein, arising from improper use of chemicals or due to failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.

### 2.2 SOD

- A. Sod shall conform to NYSDOT Item 713-14 and be approved nursery grown mineral soil sod with 60% Kentucky Bluegrass and 40% Fine Fescue blend with a minimum (4) varieties. Muck grown sod is NOT acceptable. Installation of plastic netting is NOT acceptable.
- B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch and extraneous material viable and capable of growth and development when planted. Sod is considered free of weeds when less than five (5) weeds are found per one hundred (100 s.f.) square feet.
- C. Thickness of Cut: Furnish sod machine cut at a uniform soil thickness of 0.60 inch at the time of cutting and of supplier's standard width, length, and thickness: uniformly 1" to 1-1/2" thick with clean cut edges. Measurement of thickness shall exclude top growth and thatch. Mow sod before stripping.
- D. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 1 to 1-1/2 inches.
- E. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (un-compressed).
- F. Pad Size:
  - 1. For General Lawn: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 inch on width and plus or minus 5% on length. Broken pads and torn or uneven ends will not be acceptable.
- G. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section.
- H. Standard of Quality: Shall be Premium Sod supplied by Batavia Turf (585) 548-2552, Sky High Turf Farms (315) 687-6510, Saratoga Sod Farm (518) 664-5038, Lakeside Sod (716) 741-2877 or Architect approved equal.

## 2.3 FERTILIZER

- A. For Starter Fertilization: Immediately prior to sodding, fertilize with a commercial starter fertilizer, granular, non-burning product, with not less than 90% organic slow acting, micro nutrients and 1% iron, guaranteed analysis commercial fertilizer. Fertilizer ratio shall be: (1-2-1). Apply at a rate of 0.33 - 0.66 lbs of nitrogen (N) per 1,000 sf.
- B. For Subsequent and Final Fertilizations: Apply commercial fertilizer, poly coated granular non-burning product with not less than 90% organic slow acting, guaranteed analysis
  - 1. For Spring and Fall Lawn Work: Fertilizer ratio shall be: (3-0-1). Apply at rate of 1.5 - 2 lbs nitrogen (N)/1,000 s.f.



- 2.4 WATER: Free of substance harmful to lawn, other plants, humans and animals.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Verify limits of lawn and other types of ground cover materials in the field with drawings. Also any imported and screened topsoil areas. Notify Architect of discrepancies prior to proceeding with lawn work.
- B. Examine finish surfaces, grade, topsoil quality, and depth.
- C. Do not start lawn work until unsatisfactory conditions are corrected to the satisfaction of the Architect.

### 3.2 SPREAD TOPSOIL

- A. Limit preparation to areas which will be immediately sodded.
- B. Perform topsoil spreading operations only during dry weather.
- C. To insure a proper bond with the topsoil, disc, harrow, or otherwise scarify and loosen the lawn subgrade to a depth of four (4") inches before spreading topsoil.
- D. Spread topsoil to ensure a minimum settled depth of four (4") inches in lawn areas.

### 3.3 PREPARE GENERAL LAWN AREAS

- A. Perform a pH test, sieve, and nutrient analysis of the topsoil and advise the results to the Architect prior to adding limestone or other soil amendments. Soil amendments shall be uniformly incorporated into the top four (4") inches of topsoil by discing, harrowing or other approved methods.
- B. Remove debris and stones 3/4" or larger by handpicking, fine tooth aluminum grading rakes, and mechanized stone picker. When topsoil has hardened, cultivate soil to a four (4") inch depth by plowing, discing, harrowing, or otherwise scarifying and loosening the topsoil.
- C. Grade lawn areas to a smooth, free draining even surface with a loose, moderately coarse texture. Scarify, rake, level, and roll with a light static roller as necessary to obtain true, even lawn surfaces and fill depressions as required to drain. Correct irregularities in the surface resulting from tillage operations to prevent formation of depressions or water pockets.

- D. Cultivate soil to provide a firm bed of minimum of four (4") inches deep, free of clods, stones, or foreign matter over 3/4" in diameter from the top of soil. Do not move heavy objects except necessary lawn making equipment over the lawn areas after the soil is prepared unless it is again loosened and graded. Remove stones and all debris greater than one 3/4" in diameter during cultivation. Level undulations and irregularities in the surface.
- E. For pH correction provide adjusted rate of application as recommended in Topsoil Test Report submittal. For low pH correction: Add ground limestone at the rate indicated by the soil test. For high pH correction: Materials and application rates shall be determined by appropriate soil tests.
- F. Place starter fertilizer at the rate of 0.33 - 0.66 lbs. of nitrogen (N) per 1,000 sf. and mix into full depth of topsoil.
- G. Rake area with fine toothed aluminum grading rake before placing sod to obtain a smooth surface at the proper elevation. Drag area with a wood float to level out minor humps and hollows. Beds shall have a smooth friable uniform surface, free of areas ponding water.

### 3.4 SODDING

- A. Notify Architect that sod bed is ready for review as specified in Job Conditions. Obtain Architect's approval prior to sodding.
- B. Moistening the Soil: During periods of higher than optimal temperature for species being specified and after unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to laying the sod.
- C. Sod immediately after preparation of bed and Architect's approval.
- D. Lay sod to form a solid mass with tightly-fitted joints in strips parallel to contours. Butt ends and sides of sod strips. Do not overlap edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with finish grade of adjacent curbs, pavements, drainage structures and seeded areas.
- E. Do not lay dormant sod or install sod on soil surfaces that are hot, dry, saturated or frozen.
- F. When sodding slopes, install initial row of sod in a straight line, beginning at bottom of slope. Place subsequent rows parallel to and lightly against previously installed row.
- G. Sod strips laid in drainageways must meet the finished grades shown on the drawings.
- H. Sod abutting existing lawns shall meet flush with top of sod pad (soil and thatch). Remove excess topsoil as necessary to meet flush.

- I. Stake sod in lawn swales and on lawn slopes 3H to 1V (horizontal to vertical) and steeper to prevent slippage. Use two (2) biodegradable stakes per square yard of sod. Stakes are to have their flat sides against the slope and be driven flush with sod surface.
- J. Roll with light static lawn roller to ensure contact with subgrade.
- K. As sodding is completed in anyone section, water sod thoroughly to a depth sufficient to ensure the underside of the new sod pad and topsoil immediately below the pad is thoroughly wet. Contractor is responsible to ensure there is an adequate water supply available prior to installation. Do not allow sod to dry out.

### 3.5 MAINTENANCE

- A. Maintenance by Contractor begins as soon as lawns are sodded. Protect lawns from drought, washout and wind erosion. In general, maintain new installed lawn areas, including watering, fertilizing, mowing, applications of herbicides, fungicides, insecticides, and re-sodding until a full, uniform, healthy, vigorous stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect. Specifically:
  - 1. Watering Sodded Lawns:
    - a. First Week: Soil on sod pads shall be kept moist. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least four (4") inches.
  - 2. Second and Subsequent Weeks: Contractor shall provide water to the lawns as required to maintain adequate moisture, in the upper four (4") inches of soil, necessary for the promotion of deep root growth until final acceptance. After 2<sup>nd</sup> mowing, water two (2) times weekly until thoroughly established.
  - 3. Protect: Protect lawn areas against trespass, vandalism and routine pedestrian traffic and Owner maintenance traffic by temporary fencing or other means.
  - 4. Repair: Repair, rework, resod areas that have washed out, eroded, and are vandalized or otherwise damaged.
  - 5. Mow: Initial mowing shall begin when the blade height reaches 2" and the soil will bear the weight of the lawn mower. Use mowers with low impact tires. Mow the grass when it reaches a height of about 3.5" to a height of about 2.5". Never remove more than 1/3 of the grass blade at any one mowing. A minimum of two (2) to three (3) mowings are required. Notify the Architect of dates in writing as mowing is performed. Excess clippings shall be carefully raked so as not to remove healthy grasses, and removed.
  - 6. Apply a final fertilizer just prior to final acceptance at the same application rate of 1.5-2 lbs./1,000 s.f.
  - 7. Weed Control: When infestation of weeds or crabgrass develops, treat infestation by hand weeding or herbicides control appropriate to the area. Furnish and install weed chemical control as recommended by manufacturer. Herbicides controls must be acceptable to the Owner. Obtain and pay for permits. Use as directed by the manufacturer and applicable laws, codes, ordinances and regulatory requirements.

- B. Maintenance by the Contractor continues through the certificate of substantial completion to final acceptance by the Architect as described below. Maintenance by Owner begins after final acceptance of the lawn.

3.6 STANDARDS FOR SUBSTANTIAL COMPLETION OF LAWNS: Review to determine substantial completion of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

- A. Lawn areas will be substantially complete provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, partially mature stand of lawn is established free of weeds, undesirable grass species, disease, and insects. With proper watering and maintenance as indicated herein, this should culminate after an approximate 60-72 day period for initial germination with average temperatures above 40°F. Grass roots shall have matured to a minimum of 1½" depth as determined by the Architect when core samples are taken.
- B. Lawn areas shall not have more than 10% dead/bare spots.
- C. Contractor shall provide a written copy of all maintenance activities performed up to this date.
- D. The architect will prepare a written punch list of items which need correction prior to final acceptance.

3.7 STANDARDS FOR FINAL ACCEPTANCE OF LAWNS: Review to determine final acceptance of lawns will be made by the Architect, upon request. Provide notification at least five (5) working days before requested review date.

- A. Lawn areas will be acceptable provided requirements, including maintenance, have been complied with. A healthy, vigorous, uniform, full stand of lawn is established free of weeds, undesirable grass species, disease, and insects. Grass roots shall have matured to a minimum of 2" depth as determined by the Architect when core samples are taken.
- B. Any lawn which contains disease, more than 1% dead/bare spots, or any dead/bare area greater than one (1) square foot shall be rejected and the unacceptable area(s) repaired as originally specified at no additional cost to the Owner.
- C. In the event the Contractor fails to complete the punch list items within a 30 day period with average temperatures of 40°F after the time of Substantial Completion, the Contractor shall be liable to the Owner for any additional costs including those charged by the Architect.
- D. Contractor shall provide a written copy of all maintenance activities performed during the contract up to final acceptance of lawns.

3.8 CLEAN UP

During the contract and at intervals as directed by the Architect and as lawn work is completed, clear the site of extraneous materials, rubbish, and debris. Leave the site in a clean, safe, neat, well-draining condition.

END OF SECTION 329201

## SECTION 334001 - STORM DRAINAGE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The extent of the storm drainage is shown on the drawings.
- B. Storm drainage work includes, but is not limited to:
  - 1. Trenching, backfilling and compaction
  - 2. Storm structures, castings, and appurtenances
  - 3. Piping, jointing and fittings
  - 4. Connection(s) to other storm system(s)
  - 5. Adjusting existing storm structures and other utilities
  - 6. Storm Water Management Trench (SMT)
  - 7. Storm Line Cleaning and Scoping
  - 8. Quality Control Testing and Submittals
  - 9. Clean Up
- C. Provide materials, labor, equipment and services required to accomplish related work in accordance with the drawings and specifications.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 311201 - Site Preparation
- B. Section 312501 - Erosion, Sediment and Pollution Control
- C. Section 312201 - Site Earthwork: For Elaboration of Shoring and Bracing, Dewatering, Backfilling, Compaction and Field Quality Control Testing.
- D. Section 321201 - Asphalt Paving
- E. Section 321301 - Site Concrete Work

#### 1.3 REFERENCES

- A. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

#### 1.4 SUBMITTALS:

- A. Shop Drawings (SD) required for:

1. Precast concrete drainage structures showing sizes, elevations for openings and, HS20 loading certification.
  2. Storm Water Retention Structures
  3. Area Drain Structures
- B. Manufacturer's Product Data (MPD) required for:
1. Drainage structures and castings
  2. Pipe, joints and fittings
  3. Stormwater Management Trench for Pipes and Geotextiles
- C. Quality Control Submittals:
1. Provide a list of completed projects including Owner's contact information for each project, demonstrating compliance with applicable "Experience Requirements" specified in "Quality Assurance" of this specification section.
  2. Provide Infiltration Testing Report(s) for infiltration basins as described in "Quality Assurance" of this specification section. Stormwater facility design may be adjusted by Architect depending on results of tests.

## 1.5 QUALITY ASSURANCE

- A. Drainage Contractor Experience Requirements:
1. Submit business name, business owner(s) name(s), business address, telephone number, website and/or email address signed by the Contractor/Subcontractor who meets the qualifications set forth in this specification and is proposed by the Contractor to perform the Drainage for this Project.
  2. Provide a list of at least four (4) Drainage work projects of comparable size, scope and quality completed successfully by the proposed Contractor/Subcontractor within the past three (3) years that includes the date completed, project Owner's name and current contact information, including telephone numbers and email addresses.
- B. Infiltration Testing Required by Contractor: (Subsurface Storage System)
1. Perform two (2) infiltration tests in locations as directed by the Architect and as detailed.
  2. May be done through a boring or open excavation as described in NYSDEC, Division of Water, published in Standards of Wastewater Treatment Works, 1988 or latest revision.
  3. Install casing (solid 4-6 inch diameter, 30" length) to 24" below finished grade.
  4. Remove any solid surface and provide a natural soil interface into which water may percolate. Remove all loose material from the casing. Upon the tester's discretion, a two (2") inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment. Fill casing with *clean* water to a depth of 24" and allow to pre-soak for twenty-four hours.
  5. Twenty-four hours later, refill casing with another 24" of clean water and monitor water level (measured drop from the top of the casing) for 1 hour. Repeat this procedure (filling the casing each time) three additional times, for a

total of four observations. Upon tester's discretion, the final field rate may either be the average of the four observations, or the value of the last observation. The final rate shall be reported in *inches per hour*.

6. Upon completion of the testing, the casing shall be immediately pulled, and the test pit shall be backfilled and site restored.

## 1.6 JOB CONDITIONS

- A. Job conditions in Section 312201 apply.
- B. Plan and execute piping work so that trenches are not opened for more than two hundred (200') feet in advance or left unfilled more than one hundred (100') feet behind. No overnight open excavation is permitted.
- C. **CERTIFICATION OF STORM SYSTEM:** The storm system must be installed and certified by a licensed County Plumber when required by municipal code or state law.
- D. **CONSTRUCTION REVIEW:** Notify the Architect when the storm system is approximately 25%, 50% and 95% complete.

## 1.7 SUBSTITUTIONS

- A. Contractor is responsible for design of any substituted structures, systems or units in Section 334001 by a NYS licensed engineer. Submit to Architect for approval.
- B. If a product is being submitted as a substitution to the specified product; the the Prime Contractor shall submit and request a product material substitution with his/her bid. The Prime Contractor shall at a minimum provide the following for review by the Architect and Owner:
  1. All submittals as specified herein.
  2. Product comparison
  3. Cost Information (including proposal of change in Contract Sum)
  4. Contractor's certification that proposed substitution complies with requirements in the Contract Documents
  5. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

## PART 2 - PRODUCTS

### 2.1 BACKFILL

- A. Backfill for pipes, Stormwater Management Trenches (SMT) and drainage structures shall be as specified in Section 312201.



## 2.2 STORM STRUCTURES AND CASTINGS

### A. Storm Inlets and Manholes:

1. Shall be precast reinforced portland cement concrete conforming to the size(s) and shape shown on drawings, designed for AASHTO HS-20 loading. The materials and structural design of the structures shall be per ASTM C478 and ASTM A497, Grade 60. The minimum compressive strength of the concrete in the structure base, riser, and top section shall be 5,000 psi. The minimum wall thickness shall be one twelfth of the internal diameter of the riser or largest cone diameter. All joints shall be waterproofed with O-ring rubber gaskets and sealed with a mastic treatment in accordance with ASTM C990. Any grout used within the system shall meet the ASTM C 1107. Manhole connector holes shall be equipped with a seal gasket that meets or exceeds material specification of ASTM C-923 or other locally approved methods. Base units shall be extended. Standard of quality shall be as manufactured by Zeiser Wilbert, Jefferson Concrete, Fort Miller or Architect approved equal.
2. Castings: Provide HS20 loading and bike safe grates, ductile iron meeting grade 65-45-12 as determined by ASTM A536-84, sizes as noted on the plans. Frames, covers and grates shall be machined to prohibit rocking. Standard of Quality shall be Neenah Foundry, East Jordan Iron Works, US Foundry, or Architect approved equal.

### B. Area Drain(s): Shall be a watertight PVC, HS-20 loaded drain basin with drop-in integral grates. Structures shall be able to accommodate all connecting pipes watertight. Refer to drawings for sizes and grate styles.

1. 10" Standard light-duty drop-in grate.
2. 30" Integral frame and ductile iron cover to match basin O.D.
3. Standard of quality shall be Nyloplast as distributed by Advanced Drainage Systems, Inc., 800-821 6710, or Architect approved equal.

## 2.3 STORM STRUCTURE APPURTENANCES

- A. Precast Concrete Adjustment Rings: Shall be square or round depending on structure. Built in accordance to ASTM C478, and made of 5,000 psi concrete and reinforced steel, meeting ASTM A615 Grade 60, as manufactured by Fort Miller, Zeiser Wilbert, Jefferson Concrete or Architect approved equal.
- B. Steps: Shall be copolymer polypropylene plastic reinforced with 1/2" diameter grade 60 steel as manufactured by M.A. Industries or Architect approved equal.
- C. Mortar: Shall be lime, cement, and clean sand, 1:1:3 measured by volume, meeting ASTM C1107.
- D. Coal Tar Sealer: Shall be used to coat the inside and outside of installed precast risers. Standard of quality shall be Hydralastic 836 as manufactured by W. R. Meadows, (800) 342-5976 or Architect approved equal.

## 2.4 PIPING

- A. High Density Polyethylene Pipe (HDPE): Shall be heavy duty dual wall, high density polyethylene (HDPE) pipe conforming to ASTM F2648 for 4" to 60" pipe with a smooth inner wall, annular corrugations, "n" flow rating of 0.012, and HS-20 loading capability with minimum one (1') foot cover for 4" to 48" pipe and two (2') foot cover for 60" pipe. Joint couplings for pipe shall be connected using a bell & spigot joint, meeting AASHTO M252, AASHTO M294, or ASTM F2306. The joint shall be soil tight and gaskets, when applicable, shall meet the requirements of ASTM F477. Standard of quality shall be N-12 Mega Green ST IB pipe as manufactured by Advanced Drainage Systems, Inc., 800-821 6710, or Architect approved equal.

## 2.5 STORM WATER MANAGEMENT TRENCH

- A. 4" to 10" Pipe: Shall be flexible, heavy duty, corrugated interior and exterior, perforated (or slotted) polyethylene pipe meeting requirements ASTM F-667 for 4" to 10" diameters. Standard of quality shall be ADS with prefabricated snap fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.
- B. 12" to 24" Pipe and Fittings: Shall be heavy duty polyethylene (HDPE), corrugated interior and exterior, perforated pipe meeting requirements AASHTO M252, AASHTO M294, Type C. Standard of quality shall be ADS with prefabricated fittings as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.
- C. 4" to 12" Fittings: Shall be injection molded fittings with a smooth interior and exterior meeting requirements AASHTO M252 for 4" to 10" diameters, and ASTM M294 or ASTM F2306 for 12" diameter. Standard of quality as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal. Size pipe(s) as noted on drawings.
- D. Backfill: Shall be clean, washed No. 1 stone as indicated in Section 312201.
- E. Soil Separation Fabric: Shall be a commercially manufactured non-woven polypropylene filter fabric. Standard of quality shall be Mirafi 140N as manufactured by TenCate or Architect approved equal.

## 2.6 STORM WATER RETENTION STRUCTURES

- A. Chamber Design:
  - 1. Only stormwater chamber systems evaluated by a NYS licensed design engineer and found to meet AASHTO section 12.12 safety factors will be considered.
  - 2. Stormwater chambers shall be designed in accordance with ASTM F 2418-16a or F 2922 Standard Specification for Polypropylene (PP) or Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers.
  - 3. The structural design of the chambers, the structural backfill, and the installation requirements shall ensure that the load factors specified in the AASHTO LFRD

bridge design specifications, section 12.12, are met for: 1) Long-duration dead loads and 2) Short-duration live loads, based on the AASHTO design truck with consideration for impact and multiple vehicle presences.

4. Stormwater chambers shall be designed, tested and allowable load configurations determined in accordance with ASTM F 2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". Load configurations shall include: 1) Instantaneous (<1 min) AASHTO design truck live load on minimum cover 2) Maximum permanent (75-yr) cover load and 3) Allowable cover with parked (1-week) AASHTO design truck.
5. Stormwater water retention structures standard of quality shall be:

- a. StormTech SC-310

as manufactured by Advanced Drainage Systems, Inc., (614) 457-3051 or Architect approved equal.

B. Performance:

1. Upon request by the Architect or Owner, the chamber manufacturer shall submit a structural evaluation for approval before delivering chambers to the project site as follows:
  - a. The structural evaluation shall be sealed by a NYS licensed professional engineer.
  - b. The structural evaluation shall demonstrate that the safety factors are greater than or equal to 1.95 for dead load and 1.75 for live load, the minimum required by ASTM F 2787 and by sections 3 and 12.12 of the AASHTO LFRD bridge design specifications for thermoplastic pipe.
  - c. The test derived creep modulus as specified in ASTM F 2922 shall be used for permanent dead load design except that it shall be the 75-year modulus used for design.
2. Only mechanical and material properties that were determined in accordance with ASTM test methods shall be allowed for structural design of the chambers.
3. Only chambers affixed with the ASTM F 2418-16a or F 2922 designation shall be considered as meeting ASTM F 2418-16a or F 2922.
4. The contractor shall submit design summary by the manufacturer that demonstrates that the system is designed to convey peak flow rates without scour of foundation stone.

C. Materials:

1. Chamber:
  - a. Chambers shall be arch-shaped and shall be manufactured from virgin, impact-modified polypropylene or polyethylene copolymers.
  - b. Chamber rows shall provide continuous, unobstructed internal space with no internal support panels in order to provide ease of access for inspection and maintenance functions.

- c. Inspection ports shall be installed and constructed per project plans. Note that inspection ports shall only be installed along the Treatment Row to allow for inspection of the sediment build up over time.
  - d. The chambers shall be open-bottomed.
  - e. The chamber shall incorporate an overlapping corrugation joint system to allow chamber rows of almost any length to be built. Chamber models may be cut at the job site to improve site optimization and reduce product waste.
- 2. Chambers and end caps shall be produced at an ISO 9001 certified manufacturing facility.
- 3. End Caps:
  - a. End caps shall be injection molded or roto molded from polyethylene or polypropylene resin and allow pipe connections with polyethylene pipe. End caps shall have a curved face capable of resisting typical horizontal and vertical loads.
  - b. All chamber rows shall be terminated with an end cap. End cap placement on end of chamber will vary depending on chamber model.
  - c. End caps may incorporate cutting guides to allow easy field cutting for various diameters of pipe. Cutting guides shall be located at both the top and bottom of each end cap.
- 4. Manifold Piping:
  - a. Manifold piping shall be designed to ensure that peak flows are distributed to the rows of chambers without scour of foundation stone.
  - b. Manifold piping shall be of dual wall HDPE piping such that accepted equations of hydraulics can be used as a basis for design.
- 5. Stone:
  - a. The foundation, embedment and cover stone shall be in accordance with the chamber manufacturer's installation instructions.
  - b. Foundation and Backfill for "SC" chambers shall be clean, crushed, angular stone meeting the following gradation as determined by ASTM-C136 and AASHTO M145:

| Standard Sieve Sizes | Percent Passing<br>By Weight |
|----------------------|------------------------------|
| 2" or 50 mm          | 100%                         |
| 1" or 25 mm          | 95 - 100%                    |
| 1/2" or 12.5 mm      | 25 - 60%                     |
| #4 or 4.75 mm        | 0 - 10%                      |

- 6. Fabric:
  - a. Fabric between the chamber bottom and the stone foundation located along the entire length of the Treatment Row and the first 14.5 ft of all inlet rows.

- b. Fabric shall be Mirafi 500X as manufactured by TenCate or Architect approved equal for sediment capture, filtration and scour protection.
- c. Fabric between the top of the Treatment Row chambers and the embedment stone and surrounding the entire chamber system shall be Mirafi 140N as manufactured by TenCate or Architect approved equal for filtration.
- d. If shown and labeled on the drawings, a non-reinforced 30 mil PVC liner with solvent welded seams will be installed around the entire system to prevent water migration. See manufacturer's Tech Sheet #2 for guidance on PVC liners for the system.

D. Stormwater Treatment Row:

- 1. The stormwater chamber system shall incorporate an Treatment Row for stormwater treatment and system maintenance. An Treatment Row is a chamber row enclosed in geotextile fabric for sediment capture and maintenance.
- 2. The Treatment Row shall remove a minimum of 80% of Total Suspended Solids (TSS), 80% Total Petroleum Hydrocarbons (TPH), 80% Suspended Sediment Concentration, 60% Total Phosphorus, and 605 Total Zinc as verified by 3<sup>rd</sup> party testing.
- 3. Stormwater treatment system inspection and maintenance shall be in accordance with the Operations and Maintenance (O&M) section of the Stormwater Pollution Prevention Plan (SWPPP) and the product manufacturer's published guidance.

E. Accessories:

- 1. Spacers can be used to obtain the required minimum spacing between chamber rows.
- 2. During construction inlet filters or pipe plugs on all inlet pipes to the stormwater chamber system shall be used to prevent construction sediment from entering the Treatment Row system. Pipe plugs to be removed once construction of the system is complete and no further construction sediment loading is expected.

F. Imported Granular Backfill above Stormwater Retention Structures: Shall be as specified in Section 312201, 2.1, B.

## 2.7 STORM LINE CLEANING & SCOPING

- A. Contractor shall provide one thousand (1,000) linear feet of multiple sized storm line cleaning and scoping in areas directed by the Architect and as shown on the plans.
- B. Cleaning Equipment: Acceptable cleaning equipment includes, but is not limited to, rodding machines, bucket machines, hydraulic flushers, movable dams with flexible scrapers.
- C. Scoping Equipment: Acceptable scoping equipment includes, but is not limited to, pipe inspection camera with pan-and-tilt, radial viewing that pans 275 degrees and rotates to 360 degrees. The camera shall have the following attributes:

1. Be operative in 100 percent humidity conditions.
  2. Measure with an accurate footage counter that displays on the monitor the exact distance of the camera, to the nearest tenth of a foot, from the centerline of the starting manhole.
  3. Camera with height adjustment so that the camera lens is always centered at half the inside diameter, or higher, in the pipe being televised.
  4. Lighting for the camera shall be suitable to allow a clear picture of the entire pipe periphery.
  5. The video camera shall be capable of showing on the digital inspection the Owner's name, project name, contractor name, date, line size and material, line identification (Owner's manhole numbers at both ends), ongoing footage counter, and slope and angle of pipe.
- D. For four- and six-inch lateral internal television inspections a "push camera" shall be used to produce color DVD. Camera reel shall be equipped with a footage counter to identify approximate distances from the start of the inspection.

## PART 3 - EXECUTION

### 3.1 CONNECTIONS TO OTHER STORM SYSTEM

- A. Connections to existing Storm Systems:
1. Coordinate with the Municipality and other agencies having jurisdiction. Notify governing agency in writing a minimum of two (2) weeks prior to anticipated date of connection so that field procedures and installation can be reviewed by a representative of the Municipality. Copy letter to Architect.
  2. Locate accurately per drawings. Verify inverts and sizes. Notify Architect of any discrepancies immediately, prior to installation.
  3. Make connections securely, watertight and as detailed. Provide all necessary couplers and fittings to make connections.

### 3.2 TRENCHING AND BACKFILL

- A. Reference: Refer to Section 312201 for elaboration of shoring and bracing, supporting, rock, dewatering, and backfilling.
- B. Trenching:
1. Remove material encountered to the depth shown on drawings and with a maximum width of fourteen (14") inches and a minimum of nine (9") inches each side of conduit springline as detailed. Provide safe shoring, sheeting, and bracing. Remove before backfilling. Backfill excess or over excavation as described in Section 312201 to proper line and grade. Compact to 95% density.
  2. When unsatisfactory soil materials are encountered at design elevations, immediately notify the Architect in writing via email. Continue as directed by the Architect. When conditions are not a result of Contractor's negligence,

additional excavation may be directed by the Architect and paid for as a Change Order on a unit price basis in accordance with specification Section 312201.

- C. Water: Remove from trenches; drain trenches and/or provide sump pits and pumping equipment as necessary to keep trenches stable and dry at no additional cost to the Owner.
- D. Soft Material in Trench Bottom: Dry out and stabilize or remove and replace with imported granular backfill material to achieve firm, stable foundation at no additional cost to the Owner.
- E. Rock: Remove boulders and rock within one (1'-0") foot of pipe. Provide one (1'-0") foot of granular backfill between rock and conduits at no additional cost to the Owner.
- F. Backfill: Conform to details on drawings and as specified. Compact backfill to a minimum 95% of optimum density.

### 3.3 STORM STRUCTURES INSTALLATION

- A. Pre-Cast Structures:
  - 1. Install with corresponding extended precast base section. Precast base units shall be modified in the factory to have the correct size openings for piping.
  - 2. Provide drainage structures as detailed, built to finished grades given. Backfill with imported granular backfill material around drainage structure and compact to 95% density to avoid settlement.
  - 3. Mortaring: Thoroughly wet concrete risers before laying. Mortar joints. Joints shall be completely full and struck flush.
  - 4. Install any required steps in a continuous flight, avoiding any conflict with piping.
  - 5. Construct channels in base of storm structures for positive flow from inlet to outlet piping where detailed.
  - 6. Build completed structure to avoid any infiltration or exfiltration of water except at underdrains or storm water management trenches.

### 3.4 CASTINGS

- A. Provide the type specified and shown on drawings. Build to the finish grade as shown on drawings.
- B. Set castings firmly. Loose or rocking castings shall be rejected by the Architect.
- C. Paint all installed castings (inside and outside) with two (2) coats of black rust inhibitive paint as directed by the Architect.

### 3.5 ADJUSTING EXISTING UTILITIES

Adjust existing utilities as necessary to maintain utility service and meet finished grade conditions. Existing utilities include but are not limited to; hydrants, water valves, gas valves, electric pull boxes and manholes, storm drainage structures, cable and telephone markers, fiber optic cables, sanitary cleanouts and manholes, and guy wires.

### 3.6 PIPE LAYING

- A. Shall be in accordance with ASTM D2321 and pipe manufacturer requirements.
- B. Bed pipe in granular backfill or concrete as shown on drawings, compact under springline of pipe to assure firm support. Align pipe to line and grade given in plan and profile. Set batter boards or set by laser level.
- C. Pipe joints shall be made using the flexible gaskets specified. Clean bell end of any debris and lubricate. Remove protective wrap from gasket. Do not allow lubricated section to touch dirt or backfill. Foreign matter could adhere to surface and compromise joint integrity. Push together pipes so that the gasket is firmly seated in the socket. Always push spigot end into bell, not bell end into spigot.
- D. Place backfill around pipes to equal depths on both sides as work progresses.
- E. Attach flared end sections as detailed to pipe outlets, draw up bolts tight to provide firm anchorage.
- F. "Lamp" pipes to check for misalignment and breakage after backfilling has been completed. Replace pipes deviating more than 1/2" from line or grade at no additional cost to the Owner.

### 3.7 CONCRETE CRADLES, SADDLES AND COLLARS

Shall be 4,500 psi as specified in Section 321301.

### 3.8 STORM WATER MANAGEMENT TRENCH

- A. Use only pipe which is undamaged and flexible (have not been exposed to direct sunlight for more than six (6) months causing brittleness, cracking or splitting prior to placement). Pipe shall be stored for at least twenty-four (24 hrs.) hours in an area having a minimum temperature of fifty (50) degrees F.
- B. Trenching: Remove material encountered to the depth shown on the drawings. Provide shoring, sheeting, and bracing as necessary for safety; remove before backfilling.
- C. Install continuous envelope of soil separation fabric around the backfill up to subgrade of finish material. Fill stone to proper elevation and wrap top. Overlap fabric minimum twenty-four (24") inches at top and joints. Secure fabric joints to prevent separation and infiltration of adjacent materials and separation of fabric.
- D. Install pipe sloped as shown on drawings.



- E. Compact backfill to maximum density of adjacent materials.

### 3.9 STORM WATER RETENTION STRUCTURES

- A. Locate, stabilize and protect areas prior to bed excavation. Delineate perimeter of beds with silt fence to keep silt and heavy equipment out.
- B. Chambers shall not be installed until the manufacturer's representative has completed a pre-construction meeting with installers.
- C. Install as detailed and according to manufacturer's recommendations. Do not use crushed or recycled concrete in the installation or for backfill on the installation. Compact backfill to maximum density of adjacent materials.
- D. Chambers are not to be backfilled with a dozer or an excavator situated over the chambers.
  - 1. Manufacturer recommends three backfill methods:
    - a. Stoneshooter located off the chamber bed.
    - b. Backfill as rows are built using an excavator on the foundation stone or subgrade.
    - c. Backfill from outside the excavation using a long boom hoe or excavator.
- E. The foundation stone shall be leveled and compacted prior to placing chambers.
- F. Joints between chambers shall be properly seated prior to placing chambers.
- G. Maintain minimum - nine (9") inches spacing between the chamber rows.
- H. Inlet and outlet manifolds must be inserted a minimum of twelve (12") inches into chamber end caps.
- I. Stone must be placed on the top center of the chamber to anchor the chambers in place and preserve row spacing.
- J. Continue protecting beds during and after installation until final acceptance. Prevent heavy equipment and stockpiled materials from crushing or damaging the units and misaligning the pipes. Remove and replace damaged units, pipes and materials. Do not incorporate damaged materials into any installation.

### 3.10 STORM LINE CLEANING & SCOPING

- A. Cleaning Operations:

1. Potable water withdrawal from hydrants will be allowed for utility cleaning purposes. A contractor provided hydrant meter with backflow prevention device shall be used when withdrawing water from a fire hydrant.
2. The pipe sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the utility lines and manholes.
3. Any roots which could prevent adequate internal television inspection shall be removed. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupine, and equipment such as high-velocity jet cleaners.
4. Flows diverted during cleaning operations shall be returned to the utility system.
5. Debris accumulated during cleaning operations shall be removed from the utility and disposed offsite.

B. Inspection and Scoping:

1. If during inspection of the utility section, the wastewater flow depth exceeds 20% of the inside pipe diameter, reduce the flow depth to an acceptable level by performing the inspection during minimum flow hours, bypass pumping, plugging or by pulling the camera with swab, high velocity jet nozzle or other acceptable dewatering device.
2. Video inspections performed while floating the camera is not acceptable.
3. Documentation of Television Inspection
  - a. All inspections shall be documented using a data logger and reporting system.
  - b. Inspection Logs: Computer printed location records shall be kept by the Contractor and shall clearly show the location and orientation in relation to an adjacent manhole. Other points of significance such as locations and orientations or service connections, building sewers, unusual conditions, roots, cross connections, broken pipe, presence of scale and corrosion, and other discernible features shall be recorded, and a copy of such records shall be supplied to the Owner.
  - c. Video Recordings: Video recordings shall include an audio track recorded by the inspection technician during the actual inspection work describing the parameters of the line being inspected (i.e. location, depth, diameter, pipe material, pipe slope, etc.), as well as describing connections, defects and unusual conditions observed during the inspection. Video recording playback shall be at the same speed that it was recorded. Once inspected, the DVDs shall be labeled and become the property of the Owner.
4. Perform inspection immediately after line cleaning.
5. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the utilities condition. In no case will the camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with the proper documentation of the utility conditions shall be used to move the camera through the utility line.

6. During the inspection, the camera shall be temporarily stopped at each defect along the line. The nature, location, and orientation of the defect shall be recorded by the contractor. Where defects are also active infiltration sources, the rate of infiltration in gallons per minute shall be estimated by the Contractor and recorded. The camera shall also be stopped at all service connections and identified by footage and clock orientation.
7. The camera operator shall slowly pan and tilt and beginning and ending manhole connections, each service connection, joints, visible defects and at pipe material transitions.
8. Inspections shall be continuous for pipe segments between manholes.
9. All videos, notes, file names, etc. shall be cross referenced to the project site plan.
10. Should at any interval during the inspection and scoping the camera becomes unmovable, non-functioning, or unresponsive it shall be the contractor's sole responsibility to retrieve the camera, at no additional cost to the Owner. Any damage done to the site or storm system retrieving the camera shall be corrected immediately by the Contractor to match existing conditions.

### 3.11 FIELD QUALITY CONTROL

- A. Density Testing: Perform all density testing for piping trenches and structure backfill as indicated in Section 312201.

### 3.12 CLEAN UP

- A. During the contract and at intervals as directed by the Architect and as storm drainage is completed, clear the site of pipe, trench and backfill material, stone, concrete and debris. Leave the site in a clean, safe, well draining, neat condition.
- B. Clean drainage structures, storm water management trenches and pipes: Clean out sediment, rubbish, construction debris, and foreign objects thoroughly, immediately prior to final acceptance.

END OF SECTION 334001